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Bicycle Tools—VII.

STEEL RIMS—CONTINUED.

Resuming the rim joint scarfing, mentioned in the last issue, and illustrated by Fig. 56, this hand operation is by no means so simple as it appears. The rim stock is thirty-five thousandths thick, or three and one-half hundredths, and it requires a skillful hand with the file to make a scarf half an inch long of exactly uniform taper on each end of the trough with hemmed edges, so that after brazing the joint shall show like a fine straight brass wire inlaid in the steel. Many of the G. & J. cycle rims do show this fine straight line of brazing after the rim is polished. Others show a waved line, often of uneven thickness, which indicates an imperfectly fitted joint before brazing. One end of the rim to be scarfed is grasped in leather jaws in the vise, and the other end is propped out of the way of the filer's hand by the stick *S*, Fig. 56, swiveled to the top of the bench. The files used are all bastard cut, and it is a delicate operation to file this long scarf on such thin stock with coarse, fast-cutting, large files—so much so that I fancy many a good die fitter, for instance, would find himself trying more than once before he made a satisfactory scarf in the manner here shown. As the rims have been cut exactly to length before going to the vise for scarfing, there can be no trials, and no making bad jobs good, as that would change the diameter of the finished rim, which is not tolerated. Each rim as scarfed is given the workman's private mark, as each joint-maker has to clean his own work after it has been through the brazer's hands, and the cleaning up to a perfectly even thickness takes more or less time in proportion as the scarfing is more or less perfectly done. One hand can scarf and clean up 40 rims per day, and when finished each rim presents a perfectly even thickness throughout.

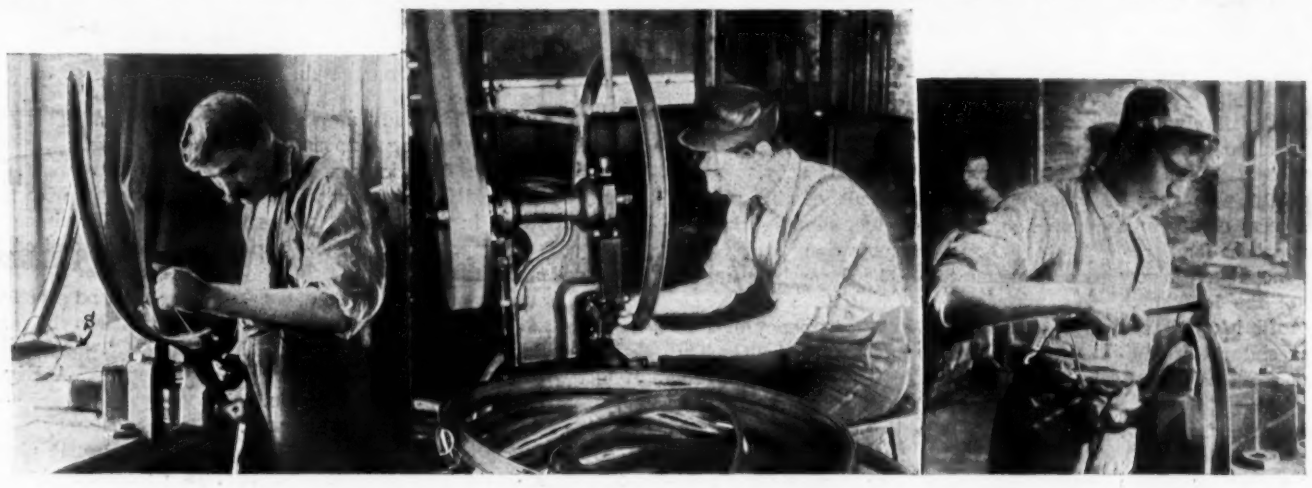
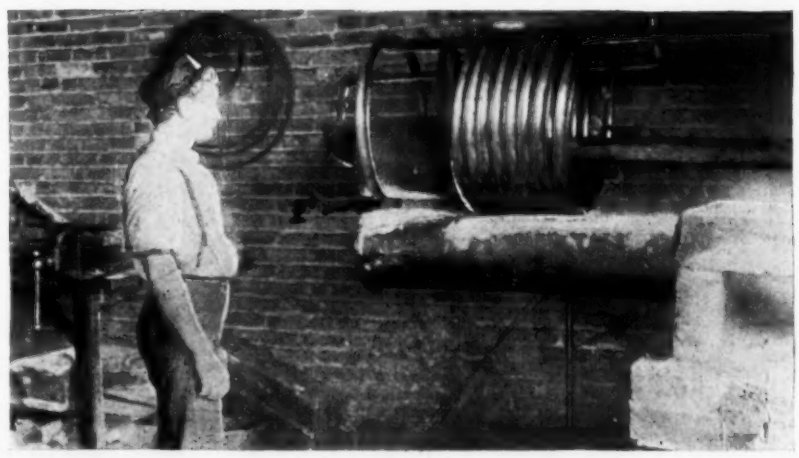


Fig. 56. MAKING STEEL RIMS.—FIG. 57. *Fig. 58.*

From the scarfing the rims go to the brazers, who first punch the brazing rivet hole, as shown in Fig. 57, using a little power press having an elevated and rounded die to fit and locate the hollow of the rim, and a stationary stripper close to the top of the die, the rim being turned to follow the curve of the die as it is slipped into place.

In Fig. 57 the top joint of the gas fixture is utilized as a top gage for the rim; the operation is simple, and the engraving leaves little to the imagination. The brazer next takes the rim to the vise, and puts in the joint rivet, as shown in Fig. 58, using a vise block hollowed to fit the inside of the rim, and after the rivet is in place the male half of the joint is made to closely fit the female part by a few dexterous strokes of the hammer applied two or three inches from the scarf, to open the trough of the male part and give it a side spring which forces the joint to lie up close on the inside all round.

The brazer next applies the brazing strip of common sheet brass, $\frac{5}{16}$ inch wide, No. 18 Birmingham gage, to the joint, by hooking each end about $\frac{1}{4}$ inch over on the inside of the edges of the trough directly over the inside joint of the scarf; ground borax mixed with water is then applied to the joint with a spoon, inside and outside, and the rims are then hung, a dozen in a bunch, on the jib of the brazing rig, as shown in Fig. 59. The brazing flame comes up from the lower fire-brick cylinder of the brazing rig at *F*, Fig. 59, and spreads out under the concave, fire-brick baffle surface of the cylinder *A*, Fig. 60, completely enveloping the rim joint, and making the braze so quickly that a thousand rims a day have been brazed on this rig, which is the best that has come under my observation. The original method was entirely different in the G. & J. shops. It does not seem right to put the brazing strip of brass on the convex top of the inside of the rim joint as it hangs in Fig. 59, and the first G. & J. method was to hang the rims on the lower cylinder *B*, Fig. 60, put in a clay dam on each side of the joint and braze with granulated spelter; this caused the bottom of the hollow of the rim to heat first and flow the spelter first at that point, and the consequence was a puddle of spelter at the bottom and imperfect brazing at the edges. By simply turning the rim the other side up, and putting the brazing strip on the inside surface of the rim, the edges of the rim are heated first, and the brazing strip flows there first, and fills the joint crevice gradually from the bottom up, the strip shrinking as by magic into a film of brown dross or oxide and filling the joint in the most perfect manner possible, and with absolute certainty. If there were too much stock in the brazing strip to fill the joint, it would stand in drops on the outer rim edge, where it would be easiest cleaned off, but the joints are so nearly alike that the strip can be cut of such width as to just fill, and most of the rims are almost perfectly clean of surplus brass when taken away from the fire. As soon as one rim is brazed the next one, which has been hanging in the edge of the flame and is pretty well heated, is pulled into place over the middle of the fire, and the brazing proceeds with great rapidity.



BRAZING RIMS.—FIG. 59.

Natural gas is used, with an air pressure of about 12 pounds, from a Rand Drill Co.'s compressor.

Fig. 60 shows the brazing rig in as much detail as a photograph can give. There are no drawings. The frame of the rig is a horizontal "⊃" of 2½-inch wrought-iron pipe, which terminates at its upper end in the bend *E*, Fig. 60, where the air comes in through the ¾-inch pipe *C C*; this "⊃" 2½-inch pipe forms the mixing chamber, and takes the gas through the pipe *G G*, at the right hand, which is tapped into the lower bend of the "⊃" at *M*. *A* and *B* are two cylinders of fire-brick clamped on the two horizontal members of the mixing pipe *F*; the baffle cylinder *A* is 24 inches long, and the flame cylinder *B* is 66 inches long; both are 12 inches diameter. *B* has a slot *N*, 1½ inches wide, reaching from the top to the mixing pipe *F*, which is plugged at the left-hand end, as shown. The burner is a slot in the top of the mixing chamber *F*, ¼ inch wide by 5 inches long, near the left-hand end, directly beneath the fire so plainly shown on *A*. The jib *J J*, on which the rims hang, is adjustably secured by pins and different holes, which do not show in the picture, to the wall bracket *P*. A supporting standard *K*, and brace *L*, under the middle of *B*, furnish the principal support, aided, however, by a link hooked into the rod *L*, suspended from the floor overhead. The air-pipe cock is at *D*, and the gas cock at *H*. The flame slot *N*, in *B*, goes back to *T*, which is a metal tie bolted across *B*, at the right-hand end of the opening through the fire-brick to *F*.

The Gormully & Jeffery shops, shown in Fig. 61, present some features that may be studied with profit, perhaps, not only by those who do or intend to manufacture bicycles, but by all who have to do with similar lines of manufacture. They are located on both sides of Franklin street and on the south side of Institute place, Chicago, Ill. The shop west of Franklin street was built first. It is in the foreground of Fig. 61, which looks east along Institute place; the building is of brick, with wooden floors and posts, and one-half the area has (counting the basement, which is full of tools, principally drop hammers and brazing fires) six floors and the other half five floors. As business increased the new shop on the east side of Franklin was added; this building is 115x100 feet on the ground and has eight floors covering the entire ground area. This is a better structure than the first shop, with which it is connected by a tunnel under Franklin street, and has iron columns, iron floor beams, slow burning floors of 3-inch Georgia pine tongued and grooved, and covered with a layer of straw board, over which is laid a wearing floor, 1 inch thick, of hard maple, not matched, so that any board can be taken out and replaced without disturbing the others. The communication between floors is in both these shops by stairways and large, slow freight elevators. The day-lighting is better than appears from the engraving, as the south side windows are on many of the floors continuous, or nearly so; the new shop is better day-lighted than the old one. As a matter of course, floors 100 feet square must be very poorly day-lighted in any multi-floored shop, and I think it safe to say that at least one-third more work could be produced in the G. & J. shops with their present floor area perfectly day-lighted. The night-lighting is by street gas with ordinary burners, and is, of course, not so good

as the day-lighting. The elevator service is inadequate, but the 100 feet square floors permit the grouping of allied processes and operations in such large divisions as to very considerably mitigate the evils of slow elevators.

Wages at the G. & J. shops are relatively high. The help used includes a considerable percentage of specialized laborers, or one-operation experts, of no general use as machinists. There are about 600 names on the pay-roll, and the weekly aggregate wage is about $9,000, or an average of about $15 per hand per week, which is relatively high, in view of the specialized laborers and a number of girls and a few boys. There is in these shops one girl machinist, who runs a small special lathe, takes care of her own tools, and is a skilful mechanic so far.

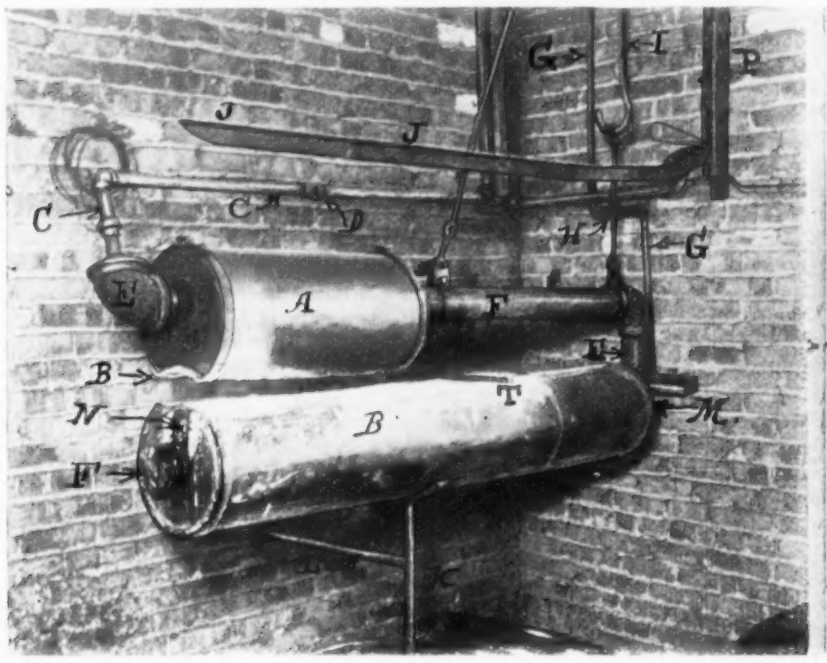
In addition to these two shops there is now going up on the east side of the last shop a new building 100x100, also of brick, with iron columns and floor beams, and the same 4-inch slow burning floor as previously specified.

T. B. Jeffery began the manufacture of bicycles by building twelve wheels in 1879. The Gormully & Jeffery shop year begins and ends in October; from October, 1894, to October, 1895, their sales were a little over 20,000 wheels; with the added floor room of the 8-story new shop, a production of from 30,000 to 35,000 wheels is anticipated for the season ending October 1, 1896.

The ground on which the G. & J. shops stand is valued at about $400 per front foot. The entire frontage is about 320 feet, making the grand value about $128,000 for 320 × 100 × 7 = 224,000 square feet of shop floor, or a land value of 57 cents per square foot of shop floor. If these shops were where they now are and only one story high, with north roof light, the figures would be as follows: 2,240 feet frontage at $400 per foot would make the ground value $896,000, which would give an investment for ground of $768,000 more than at present, which, at 4 per cent. interest, would mean an addition of $30,720 to the general expense account. The present pay-roll at $9,000 per week is $468,000 yearly.

Supposing 10 per cent. of this pay-roll could be saved by perfect shop lighting and perfect shop transportation, this alone would amount to $46,800 yearly saving, or over $16,000 more than the increase of the interest account by the occupancy of sufficient ground to manufacture the G. & J. output in a single floored shop. But, again, as the G. & J. shops now stand, not more than two-thirds the floor area can be counted as fully available for manufacturing purposes. Hence if these figures were accurately carried out, and the constant increase in Chicago land values were included in the computation, it would at once be seen that it is not economy to build and use a multi-floored machine shop, with a land value of $400 per front foot for a depth of 100 feet; and a constant inspection of the machine shops of the United States every day affords new and striking proofs to me that the multi-floored machine shop in every instance is an economic error. If shops can be placed on ground at, say, $50 per front foot for 125 feet depth, the figures show at once a good profit to be gained or lost by the style of shop structure used, but the very strong desire of workmen for aggregation makes it much easier to find suitable labor to fill a shop in the heart of the town than in the suburbs, while a shop in the country finds the difficulty of securing suitable help to more than offset all the advantages of low ground rates, low living expenses, fresh air, separate homes for workmen, and all the long list of better life conditions which pertain to existence in the country. Thus the Liberty Cycle shops, which I photographed last April at Rockaway, New Jersey, in simply idyllic geographical surroundings, are now, or are very soon to be, removed to Bridgeport, Conn., because that busy hive of metal workers can furnish shop help of any class in any numbers at a moment's notice.

HUGH DOLNAR.



BRAZING APPARATUS.—FIG. 60.

GORMULLY & JEFFERY SHOPS.—FIG. 61.

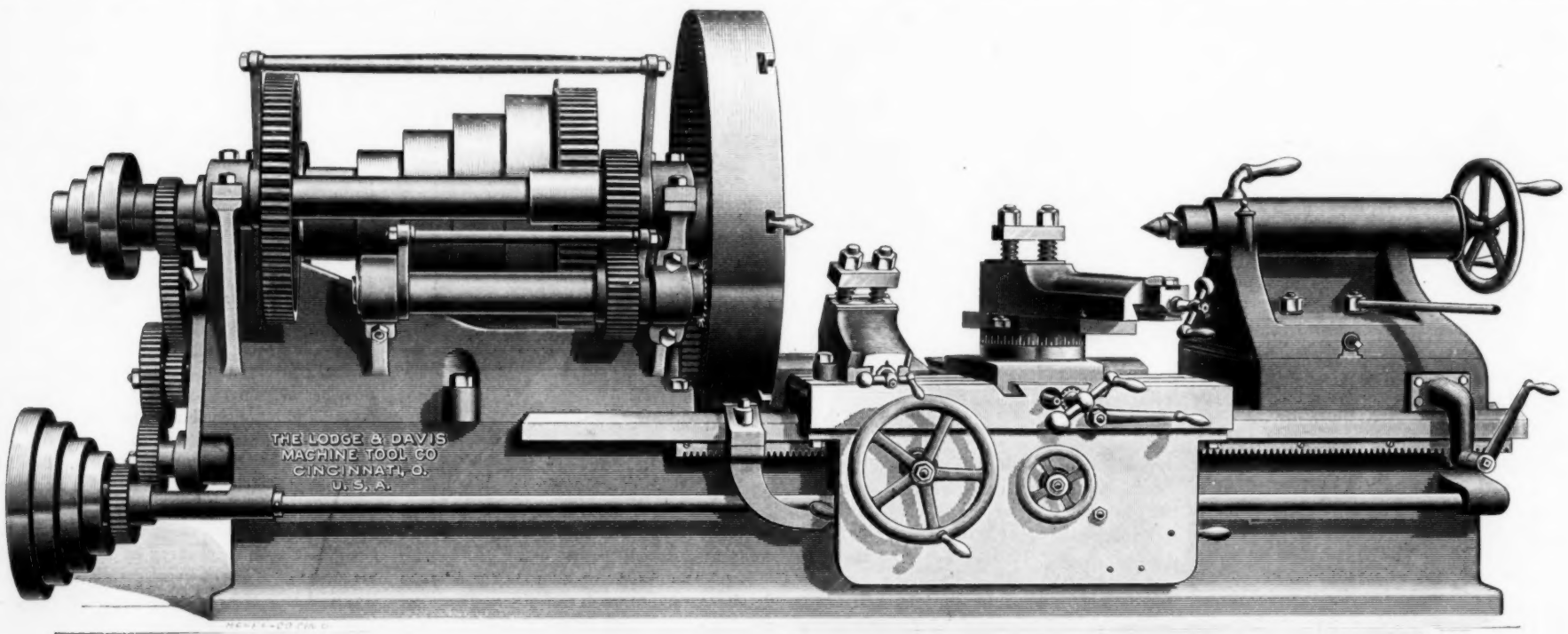
Forty-eight-Inch Triple Geared Lathe.

The accompanying illustration is of a 48-inch triple geared lathe, built by the Lodge & Davis Machine Tool Co., of Cincinnati, Ohio.

Most of the features of the tool will be readily understood from an inspection of the engraving, and it is necessary to call attention to a few points only.

The spindle is of crucible steel and has ground bearings running in bronze boxes. The lead screw is inside the bed, nearest the resistance, and is engaged by a split nut embracing its entire circumference. The feed mechanism of the apron is of new design and dispenses with the use of worm gearing. All feeds are reversed in the apron, and there is power feed for the compound rest, which operates at any angle, and when in action the cross feed cannot be thrown in. This greatly facilitates turning and boring tapers without the necessity for taper attachment. There is an automatic stop for the carriage, and when cutting screws the pinion can be disengaged from the rack, if desired.

The change gears can be connected to the feed rod and give feeds ranging from 100 to 5 per inch in the carriage feed or cross feed.

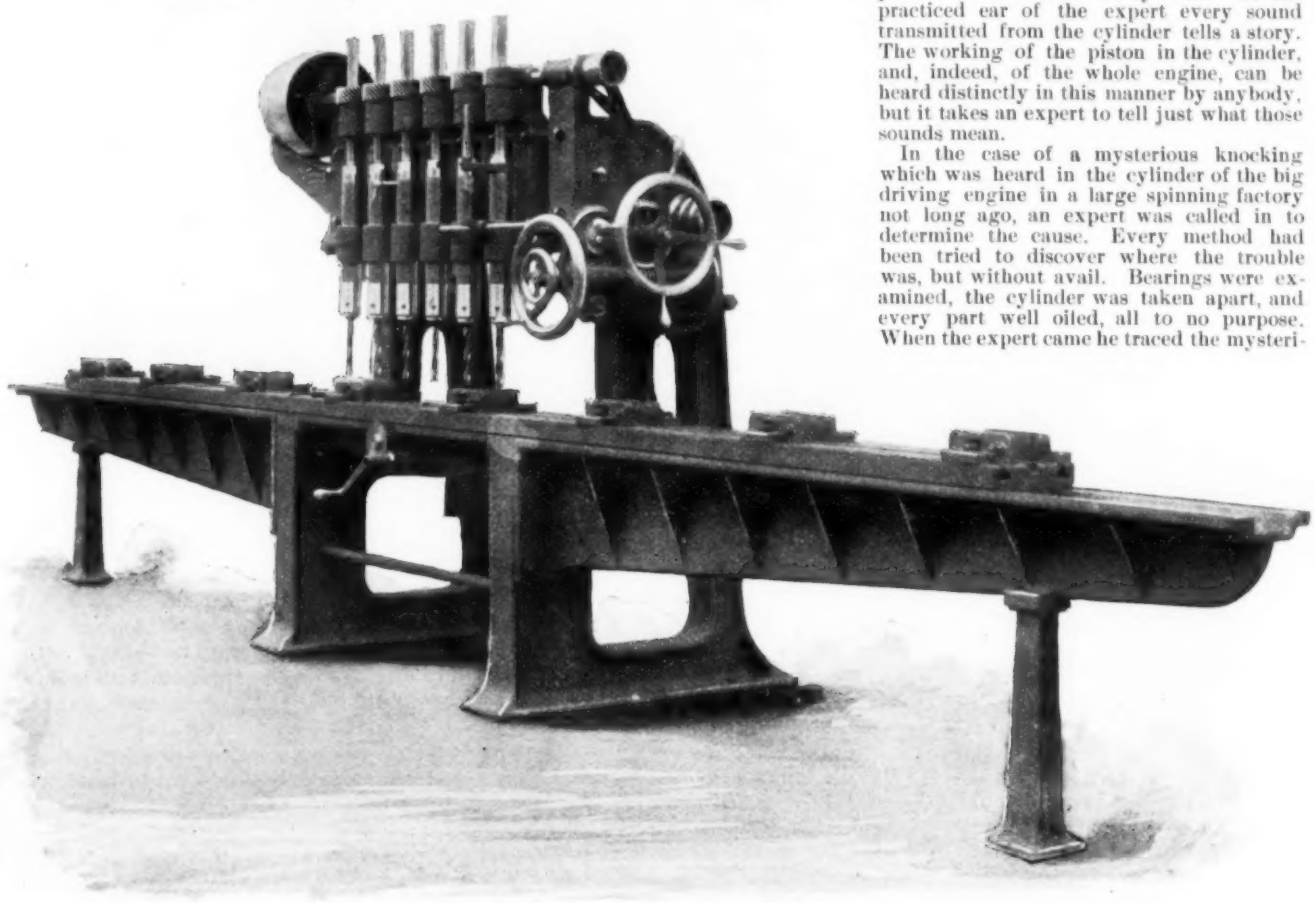


FORTY-EIGHT-INCH TRIPLE GEARED LATHE.

A Big Chimney.

The chimney recently completed for the Edison electric plant at Paterson, N. J., is the second highest in the State, the tallest being that of the Clark O. N. T. Co., at Newark. The Paterson chimney, which is 230 feet high, 21 feet in diameter at the bottom, and 13 feet near the top, then spreading to 16 feet 6 inches. The outer wall is 6 feet thick at the bottom, and 1 foot near the top. There is an air space of 8

inches, and the inner wall runs up 130 feet, being strengthened every 15 feet by iron bands. Where the inside wall ends an offset covers and closes the air space. The iron cap of the chimney is of iron in eight sections, and weighs 6,000 pounds. The chimney was erected in six weeks, an electric hoist being employed for raising the material. Nearly 1,000,000 bricks were used, costing, with the other material, $100,000.



Gang Drilling Machine.

We give on this page illustrations of a multiple spindle drilling machine recently built by the Fitchburg Machine Works, Fitchburg, Mass.

The six spindles are all driven from the horizontal shaft by helical gears, and the distance from center to center of spindles can be adjusted by rack and pinion from a minimum of 4 inches to 6½ inches.

The feed mechanism is clearly shown in the photograph, and we also give a working drawing of it, Fig. 2, in which *a* is a tappet rod which is adjustable vertically on the right-hand spindle, so that it will trip the feed at any desired point, all the spindles being provided with adjustable collets so that the drills can be brought to the work or be set to reach the required depth simultaneously.

The rod *a* depresses the tappet *b*, which raises *c* and *d* and disengages the hook *e*, allowing the arm *f* to fall and thus disengage the worm. The small hand-wheel engages the friction, the large one in front gives the hand feed and the large one at the side the fast hand feed and quick return.

The table is 16 feet long and is moved by the crank handle shown and suitable gears. The bed is 20 feet long. The spindles are 1⅛ inches diameter in the bearing and are fitted with collets for No. 2 Morse taper. The machine has a capacity to drill ¾ inch holes in steel, and weighs 5,100 pounds.

Doctor of Machinery.

As a fine example of what the space writer can do when he puts forth a special effort and goes into the intricacies of a subject he knows nothing about, an article entitled "Doctor of Machinery," which recently appeared in the New York *Tribune*, easily takes the lead. A friend sends it to us with a letter, in which he says the writer is evidently in need of a doctor. We reprint a few of the most touching passages, as follows:

Among the multitudinous trades and professions in New York there are many which are entirely unknown, even by name, to the general public. One of the least known and most interesting is that of the expert in machinery. The work of a machinery specialist is far higher than that of a skilled engineer, and many years of experience and special training are necessary to fit the expert for his duties. There are only about half a dozen of these men in the country, one in every large city. When anything goes wrong with a machinery plant of whatever nature the cause of which the engineer in charge, frequently the builder of the engines, cannot discover, the machinery doctor is called in. Every chief engineer of a big plant may be called a specialist so far as the machinery under his charge is concerned, but the specialist in machinery is an expert in engines of every description.

Though he has never seen the engine before, he rapidly diagnoses the case and prescribes a remedy, just as a doctor does for a sick patient. The instrument most used by him is a dentophone, which consists of a thin steel rod about a foot long, which he holds between his teeth and applies to the head of the cylinder. To the practiced ear of the expert every sound transmitted from the cylinder tells a story. The working of the piston in the cylinder, and, indeed, of the whole engine, can be heard distinctly in this manner by anybody, but it takes an expert to tell just what those sounds mean.

In the case of a mysterious knocking which was heard in the cylinder of the big driving engine in a large spinning factory not long ago, an expert was called in to determine the cause. Every method had been tried to discover where the trouble was, but without avail. Bearings were examined, the cylinder was taken apart, and every part well oiled, all to no purpose. When the expert came he traced the mysterious knocking from the cylinder, along the piston rod, crank shaft, and through the main shaft, away off among the looms, where one of the looms was found to be the cause of the trouble.

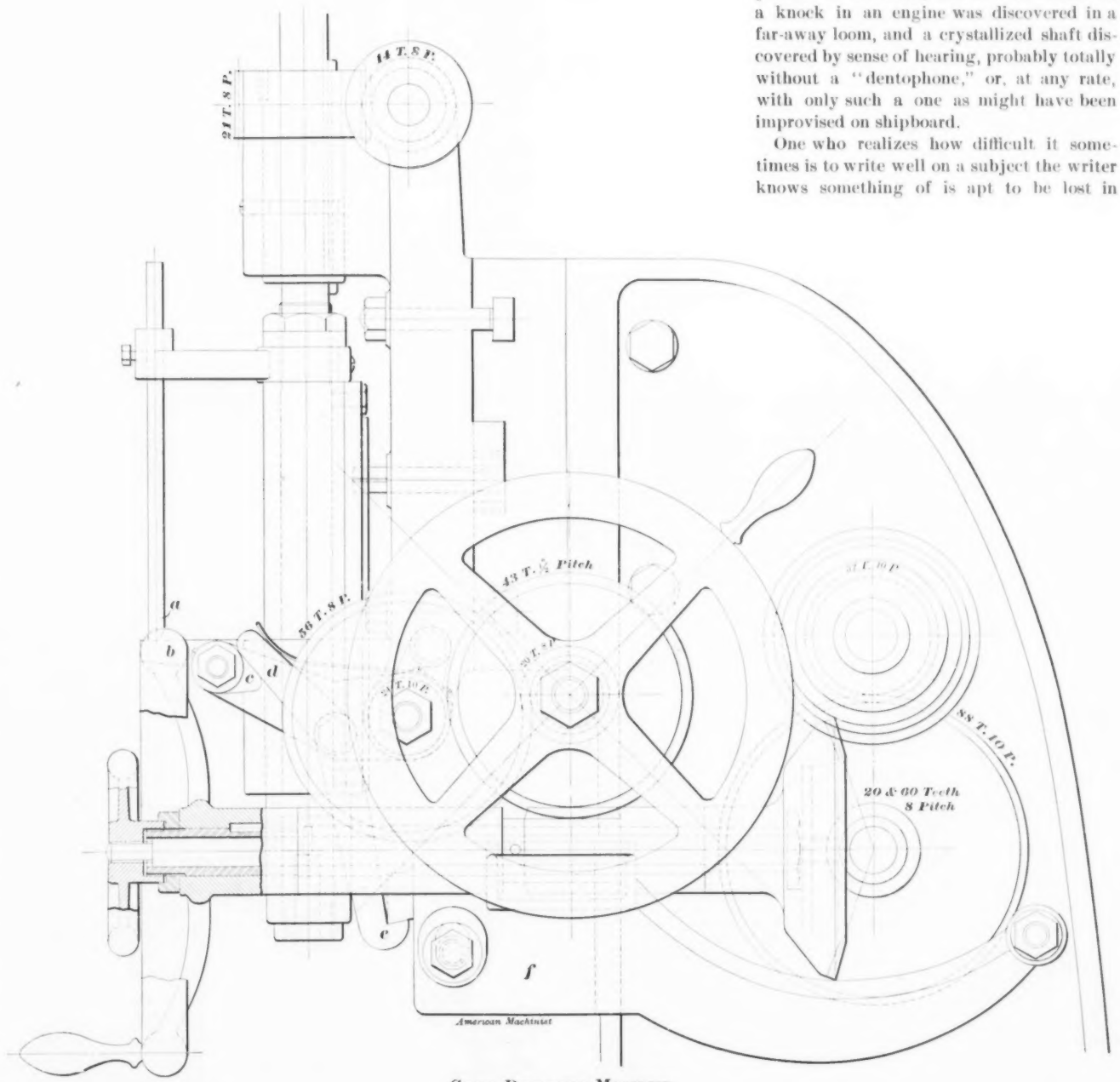
Often an expert's services are required in the case of synchronizing looms. If all the looms in a big spinning factory happen to beat together, as sometimes happens, the vibration is strong enough to bring the building down. . . .

Part of the business of the machinery doctor consists in so arranging the distribution of looms and other machinery that their working will not endanger the stability of the factory. Defects in a boiler can also be instantly determined by the practiced ear of the specialist. A plate in the boiler is selected which is known to be in good condition, and he takes mental note of the pitch of the sound made when the plate is struck with a hammer. All the other plates are struck in the same way, and any one which does not ring true and conform to the correct pitch is examined and replaced. A case is on record where a machinery specialist was crossing the ocean and detected crystallization in the center of the shaft, thereby averting what might have been a serious accident in mid-ocean. Measures were taken to strengthen the shaft in the place where the quick ear of the expert detected weakness, and when the vessel was docked his suspicions proved correct.

Few men, even with the most exhaustive training, can become experts at this business, as it requires a marvelous quickness of ear and delicate perception of sound with which few men are blessed. Technical knowledge is of little avail of itself, and a fine engineer might be a poor machinery doctor, just as a great musician might make an indifferent piano tuner. Whenever a big mill is erected, a specialist is always consulted as to the placing of the machinery, and his fee is generally well worth the expense and trouble which an injudicious distribution of machines may cause.

Where all are so brilliant it is perhaps rather bold in us to attempt to point out passages that outshine the others, but we venture to call attention to the extreme and hitherto unsuspected rarity of this new variety of doctor, and we wish especially to direct attention to the refulgence of those passages in which the use of the "dentophone" is set forth, and how the cause of a knock in an engine was discovered in a far-away loom, and a crystallized shaft discovered by sense of hearing, probably totally without a "dentophone," or, at any rate, with only such a one as might have been improvised on shipboard.

One who realizes how difficult it sometimes is to write well on a subject the writer knows something of is apt to be lost in



GANG DRILLING MACHINE.

admiration of the genius who can write such entertaining stuff on a subject of which he is so entirely and so charmingly ignorant.

A South African Industrial Exhibition.

It is too tame and slow to say that the world moves. It whizzes and hums all through. A great International Industrial Exhibition is announced to be held in May or June next, at Johannesburg, South Africa. The months named are the winter months of the southern hemisphere, and the weather there at that season carries no suggestion of discomfort. Johannesburg, it may be noted, is at this moment one of the most go-ahead places on the surface of the globe, and is fully up to date. The success of this exhibition cannot be doubted. The population of The Rand, as the district is called, are a pleasure-seeking and an amusement-loving people. They make money rapidly, and they know how to spend it. The preparations for the exhibition are well under way, and the exhibition is to be carried out upon a liberal scale. The government of the South African Republic is in hearty sympathy with the undertaking, and President Kruger is to be also the president of the exhibition, with working committees of influential men. Numerous applications are pouring in from Natal and Cape Colony, and British and American exhibitors are to be largely represented. The various railways of South Africa have promised their co-operation and assistance, with special excursion arrangements and facilities for the transport of exhibits. The chief departments of the exhibition will be the displays of mining and of agricultural machinery. As to the mining exhibit, it goes without saying that the Johannesburg exhibition will be unique so far as South Africa is concerned. Mining and milling plants of every description will be on the ground, and in every possible way that the industry can be represented on such an occasion it will here be in evidence. Everything is to be done to encourage to the fullest possible extent an interest in the agricultural development of the country, as it is felt that that industry has not as yet received in the Republic the attention which it deserves. The mining industry has brought a great settled population, and agriculture cannot now fail to attract the attention of many desirous of finding fresh and paying openings for their enterprise and capital. In both of these lines American exhibitors must be intensely interested, vast quantities of American mining machinery being already in operation in that region. All the other departments of a full-fledged universal exhibition are to be in full blast, even a special South African loan exhibition, and, by the courtesy of the government, a collection of historical relics. Altogether the forthcoming show promises to be a great event and productive of a vast amount of good in the general dissemination of knowledge, and the quickening and broadening of industry.

Hydraulic Punching Machine.

We give an illustration of a hydraulic punching machine with 36 inches depth of throat, and with a capacity to punch flue holes up to 4½ inches diameter in boiler heads, or ⅝ inch steel plates.

The upper horizontal pipe brings the water to the machine and the upward branch in front communicates with the lifting ram on top and keeps a pressure under it at all times. The larger ram below is operated by the hand lever seen in front, which controls a valve by which water pressure is admitted to or released from the large ram, and a tappet is attached to the right-hand lifting rod which automatically releases the water at any desired stroke. The lower horizontal pipe is the exhaust pipe.

With water at 1,500 pounds per square inch pressure the press will exert a force of about 150 tons and will make about twelve strokes per minute.

No leather packings are used in either ram, but instead a specially prepared plaited hemp is used.

The machine is made by Wm. H. Wood, Media, Del. Co., Pa.

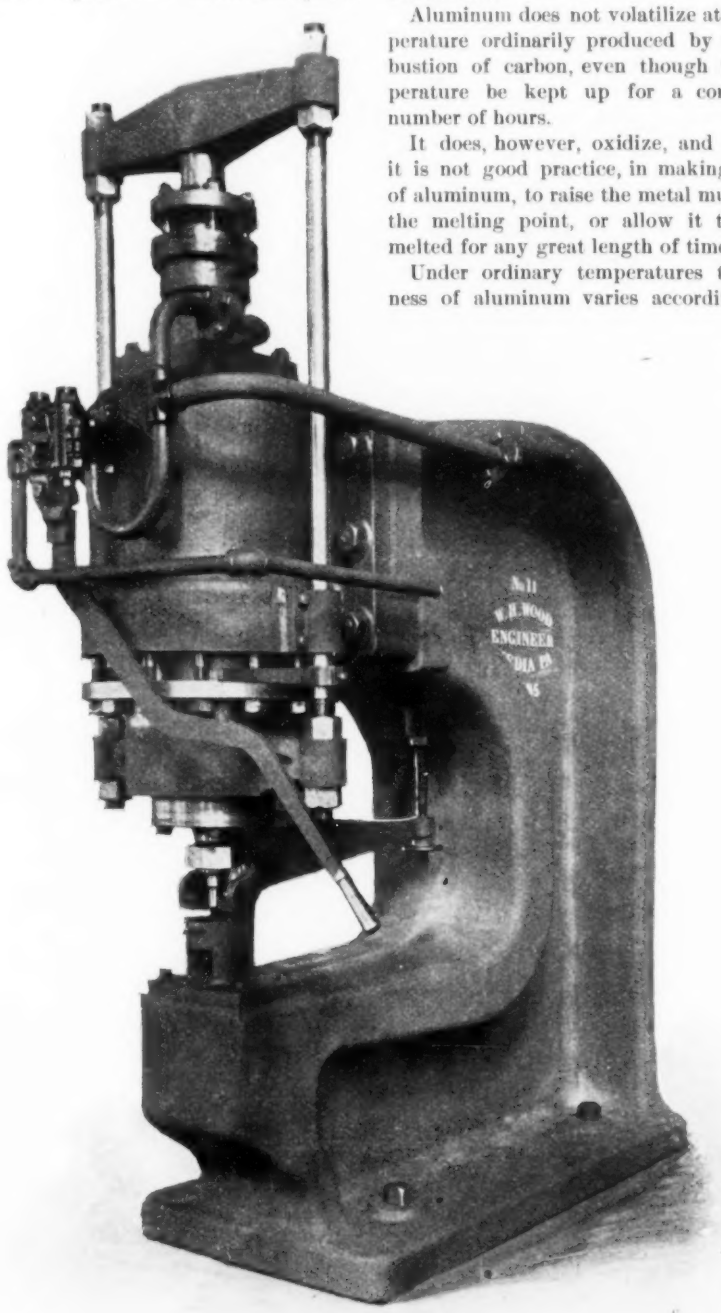
Aluminum.*

The ordinary aluminum of commerce runs about 99 or 99.25 per cent. pure, the impurities being iron and silicon in about the following proportions:

Aluminum, 99.25 per cent.
Silicon, .50 per cent.
Iron, .25 per cent.

Aluminum can be and has been made as high as 99.90 per cent. pure, the impurity in the case being all silicon.

Pure aluminum does not tarnish from the influence of weather, except very slowly, even when exposed in a moist atmosphere.



HYDRAULIC PUNCHING MACHINE.

The action of salt water on pure aluminum is extremely slight, and it withstands the action of sea water much better than iron or steel.

Aluminum, however, does collect the barnacles, very much the same way that steel does, although not quite so rapidly.

The more alloy aluminum contains, the greater the action of salt water upon it, especially those alloys of aluminum which contain zinc.

Hydrochloric acid is its natural solvent. Dilute sulphuric acid slowly dissolves aluminum on heating, with the evolution of sulphurous acid gas. Concentrated sulphuric acid acts only very slowly on the metal, although the sulphuric acid of commerce usually contains an amount of hydrochloric acid sufficient to rapidly act on the metal.

The presence of any chlorides in the solution causes the metal to be more rapidly decomposed.

Nitric acid, either concentrated or dilute, has very little action on aluminum when cold. When heated it acts very slowly.

Sulphur has no action on it at a temperature less than a red heat. Solutions of caustic alkalies, chlorine, bromine, iodine, and fluorine rapidly corrode the metal.

Aluminum melts at a temperature of 625 degrees centigrade, or 1,157 Fahrenheit.

Zinc being 415 centigrade, or 779 Fahrenheit.

Silver being 945 centigrade, or 1,733 Fahrenheit.

Copper being 1,054 centigrade, or 1,929 Fahrenheit.

Aluminum does not volatilize at any temperature ordinarily produced by the combustion of carbon, even though this temperature be kept up for a considerable number of hours.

It does, however, oxidize, and therefore it is not good practice, in making castings of aluminum, to raise the metal much above the melting point, or allow it to remain melted for any great length of time.

Under ordinary temperatures the hardness of aluminum varies according to its purity, the purest metal, of course, being the softest.

The ordinary commercial aluminum is about of the same degree of hardness as commercial copper, and, in fact, pure aluminum acts very much like pure copper, as it hardens remarkably fast when being worked either by forging, hydraulic pressure, rolling, stamping, spinning, or treated in some such similar way.

One of the reasons that one hears it said sometimes that aluminum castings are not strong enough to do the work is that people will ask for pure aluminum castings, or buy the pure aluminum and make the castings themselves; and, as previously stated, pure aluminum does not make a very strong casting, and there is not one casting in fifty which is ordinarily made of aluminum that should be made of pure aluminum.

There is just the same difference between an aluminum casting with a few per cent. of alloy in it, and the pure aluminum casting, as there is between brass and copper, and, except for special electrical work, very few people would think of having a pure copper casting made.

The coefficient of linear expansion of aluminum, 98.5 per cent. pure, is .0000206 per degree centigrade; that of iron being .0000122, tin .0000217, and copper .00001718.

The shrinkage of pure aluminum in casting is $\frac{13}{64}$ of an inch to the foot, to be exact; but it is generally taken, in making castings, as ¼ inch, or about that of brass. The shrinkage of the nickel aluminum alloys is much less and can be safely reckoned as being only equivalent to that of brass.

Pure aluminum is very sonorous, and its tone seems to be improved by using an alloy with a small percentage of silver, or copper and nickel.

The best results can be obtained, in casting aluminum and its alloys, by melting the aluminum in the ordinary plumbago crucible, similar to those which are used for melting brass or copper, and, if the metal is not overheated, it will not absorb any appreciable amount of silicon from the crucible.

Aluminum does not unite with or absorb carbon, under any of the ordinary conditions, when the two are heated together.

As previously stated the metal is non-volatile at any of the ordinary temperatures, and in order to prevent oxidation it is not necessary to cover with any substance the metal which is being melted.

A thin film of oxide will form on the surface of the metal when melted, but it is not enough to injure the castings made from it, as this thin film protects the metal underneath from further oxidation.

In casting aluminum practically the same rules should be followed as in making brass or bronze castings.

Either sand or iron molds may be used, the best result being derived by using iron molds; but, under certain conditions, the aluminum blows away from the iron if this method of casting is not properly understood and proper precautions taken. The best bicycle castings are made in iron molds, although the majority of the more ordinary castings used in commerce are made from sand.

In making up molds for casting aluminum as large a gate and as high a riser should be used as is convenient, for the reason that, in the thin casting, one needs quite a head of metal to force the molten metal to the most distant part of the molds; and then, again, one should have such a volume of metal in the gate that the casting should grow cold before the gate gets cold, in order that, as the metal in the casting shrinks, the liquid metal in the gate will flow in and take its place.

After the aluminum ingots have been cast and rolled into sheets, there are many cases where it is necessary to anneal the aluminum before the rolling is carried further, as is the case when the sheet is desired soft for stamping or spinning.

This process of annealing is accomplished by heating the aluminum sheets in a muffled furnace to such a degree of heat as would raise a piece of steel to a dull red, which is in the neighborhood of 700° Fahrenheit, great care being taken that the aluminum is thoroughly heated through, and not only on the surface.

There are many ways of telling when the sheet or wire, as the case may be, has been annealed enough, as its temperature varies according to the form of the piece or thickness of the sheet being annealed.

But, for ordinary purposes, take a pine stick and if, when drawn across the sheet of aluminum which has been heated, the stick is charred and leaves a black mark behind it, the metal is sufficiently annealed to proceed with further operations on it.

After removing the metal from the muffle it should be allowed to cool slowly. This is accomplished in many different ways.

A lead pipe was recently taken up, which, it is related, had carried water to a farm-house for 74 years.

*Extracts from a paper on "Aluminum: Its Alloys and Their Use in Ship Construction," read by J. C. McGuire at the third general meeting of the Society of Naval Architects and Marine Engineers.

Bicycle Spoke-Threading Machine.

The manufacture of bicycles has attained such magnitude that it has become expedient in many cases to design and build machinery in which every other consideration is subordinated to the one object of doing a single operation in the best manner and at the most rapid rate.

SPOKE-THREADING MACHINE.

An example of such a machine is shown in the accompanying illustration. It is made for threading the spokes of bicycles, and with a boy to operate it will cut good threads upon them at the rate of about 5,000 spokes per day of ten hours.

The machine uses a solid die, which is made in the manner that has proven highly efficient in other classes of thread cutting, and the machine is so arranged that the various operations of clamping the spoke in the vise, releasing it again after being cut, and reversing the spindle, are all performed automatically, and thus necessarily at the right moment.

A spoke being put in position and the lever moved to advance it toward the die, the first effect is to tighten the vise, which is accomplished by means of the rack and pinion seen. The advance of the vise carriage automatically reverses the spindle at the proper point, and the die is run off at about twice the cutting speed, and upon being drawn back the vise is again automatically opened and the spindle reversed ready for cutting.

The small pulley seen at the back drives an oil pump by which the die is always flooded.

The reversing device is made specially sensitive, and will reverse very close to any desired point.

The base of the pedestal is 15″x18″, the top of the lever is 42″ from the floor, and the machine weighs about 200 pounds. It is made by the Webster Tool Co., Springfield, Ohio.

Setting a Milling Cutter—Boring and Inside Threading Tools—Making Soft Metal Molds.

BY A. H. CLEAVES.

Where it is desired to set a milling cutter exactly on the line of centers of the milling machine, before setting the table at the required angle, or when it is necessary to set any cutter central for gear cutting, for example, without setting the table on an angle, an old reliable method is worth remembering. Put any piece of round brass in the milling machine chuck and run the cutter down over the end, as shown at Fig. 1, setting the cutter approximately near the center. After marking down one side, as seen at *a*, revolve the work half way around and mark as before; then the cutter *c* can be moved to the line and a deeper cut made, the work being turned as described and the cutter shifted and sunk a little deeper each time, until it will pass down the cut without showing any difference when the milling machine head is revolved half around.

To see the work plainly, place a gas jet or other light, or a sheet of white paper under the cutter, when in the work, and look down from above on it.

In taking out the stock on a square thread screw, a rounded rather than a square-nosed tool works the best for a starter.

The same is true of a gang of mill saws, such as are used for opening the key slots in a cash register. Saws with square teeth are noisy and unsatisfactory, while a lot of round tooth ones run smoothly and effectively.

When steel screws cut rough where oil is used, they will frequently cut very smoothly by using turpentine, while the point of the thread tool will be preserved much longer.

While on the subject of screw cutting and thread tools, I will call attention to an exceedingly useful and at the same time inexpensive tool found partially illustrated in Fig. 2.

In this cut a forging *A* is shown in two views—side and top. The part in the tool post is dressed off in the shaper or otherwise, and made to fill as nearly as possible and yet be movable. I made one to fit a Blaisdell lathe tool post, 1¼″x⅞″, the forging being wider in front, or one inch, to allow of receiving a ⅝ inch round tool shank.

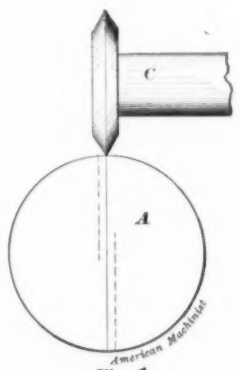


Fig. 1

The forging has a bracket for bracing screw *C*, furnished with check nut; and this screw when needed can rest against the saddle *D*, removing the strain from the cross slide above, as well as from the tool post or tool at that place.

A description of several uses to which such a tool can be put, as well as the one which led to its construction by myself, may serve to recommend it to others.

Some time since I had occasion to look after the making of a model firearm, in which the customer desired, before cutting open the stock, to have two opposite and equal lugs cut and threaded on the interior, to start at a particular place in relation to the gun stock when vertical. Fig. 3 will simplify the thing I wish to explain, if the violence done to the rules of drawing is overlooked.

Let *a* represent one of the lugs in correct position to commence work on at *a′*. The lathe is geared and locked to cut a five per inch thread. Throw off the driving belts overhead, take up any backlash on the lathe, and pull the lathe by hand, until, the lead screw moving the carriage at the same time, the line *e* on the face of the work at *d* stands opposite the lip of thread tool *c*, and the center line of the lathe. This line *e* corresponds with the nearest point on the face of the lug or *f*, and the distance from this point to the face of the work *d* is accurately gaged by the screw *h*, as seen at *g*. This gage is set before a window or strong light before the tool *E*, Fig. 2, is put into the holder for turning the chambers and getting the shoulders before threading the lugs, and can be used now for setting the tool, as shown in Fig. 3, preferably to pushing the same up against *a*. Supplementary gaging can be done with slips like *L*, Fig. 2. When the lathe carriage is positioned by the lead screw, and the line *e* has been brought to place and stopped, then the tool *E*, Fig. 2, is brought into position, as seen in Fig. 3, and stopped by screw *h*. Then the set screw *F*, Fig. 2, is tightened, and the collar *G* loosened and pushed back out of the way.

The in and out rocking-horse method of cutting the face of the lug can be applied now with accuracy.

The depth of the cut can be regulated by the length of the lip on the thread tool from the shank, or by the stop screw on the cross-slide used for thread cutting.

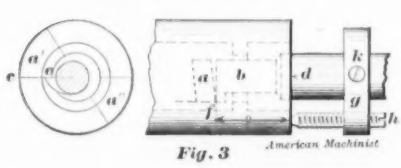


Fig. 3

I am aware that the use of such a tool in the manner described in this particular case may not occur twice in a lifetime; but the principle illustrated is a general one, and applies to hundreds of cases.

For example, an inside thread tool that has been broken or dulled can be removed, reforged, ground, or sharpened at will, and replaced positively right more readily than an outside one can be re-located by the common method of knocking and trying.

Where a compound rest is on an engine lathe the outside thread tool can be reset quickly with the slide rest on angle, and fed into the work with the regular cross-feed screw.

But for inside thread cutting, boring or turning, the gaging can be done as described above, away from the lathe, in a strong light, and with an eye glass, if needed.

When returned to the lathe and put in the holder it coincides with the lathe centers, the whole thing having been lined by them to start with, as shown at Fig. 2. With this device the thread nut can be uncoupled, the carriage run back, tool honed for finishing cut, etc., replaced and set at the exact place of starting, after the threading has commenced.

At Fig. 2 is shown how V and square thread tools can be made for the specific work they are intended to do, and used with this fixture. They can be turned on centers, and useless stock milled away, or may be marked and filed off to right pitch. An arbor *E* can be used without flattening the top, tightened with brass seat under the set screw *F*, fitting the curve on *E*, so that circular cutters like *J*, shown in three positions, can be used and ground as often as required without changing the shape, *E* being revolved to bring them into position.

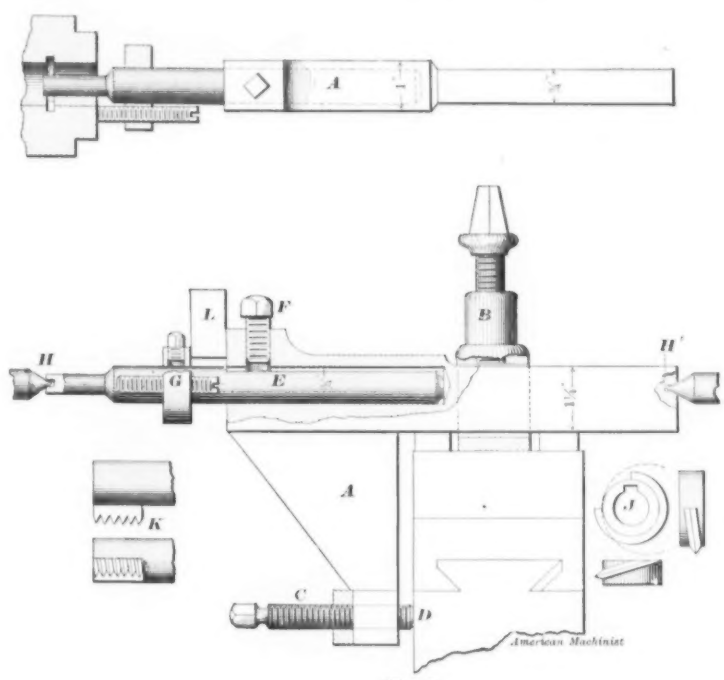


Fig. 2

BORING AND THREADING TOOLS.

K shows chaser made on a tool in the same way; being better than a single point for some work.

As a final example of the utility of this tool, I have sketched a syringe joint or valve mold, Fig. 4, showing its gate, cores, etc., and while the drawing is before us it may be well to touch upon the methods employed in such work.

In this figure *A* is one-half of the body of the mold. Cast-iron molds for this kind of work are blued before being used, and heated when in use, so that they will hiss when touched with the wet finger.

The molder will dip them into the tank of metal, and heat them properly with a little practice; while handling them fast in usage will keep them at the required heat. If too hot when in use the metal will tin the mold and stick to it.

In heating up a ladle or kettle of metal it is customary to heat the same until it will scorch a piece of soft pine.

The halves *A* of the molds are surfaced down, or used to be, before commencing work on them, by touching them on surface blocks thinly coated with red lead or lamp black, and filing off the marked places. For nice surface-fitting, however, nothing will compare with those surfaces on steel or cast-iron that are obtained by rubbing on a smooth, flat, cast-iron bench block wet with benzine until the benzine evaporates and a bright spot is left on the work. Clean waste can be used to wipe the block for getting the work spotted faster, but when nearly surfaced by scraping a little hard rubbing will bring the whole surface to a hard glossy face, as the benzine dries off while rubbing.

Small hardened steel faces can be brought down by the same process apart from scraping, using emery, corundum or diamantine with the benzine, and wiping the charged block clean for a finish. Then using benzine, and pushing the work in direct lines instead of rotating it, a dead flat mirror pol

ish is obtained. This works admirably for small irregular-shaped, hardened steel pieces.

Glass mold edges are surfaced by holding over a lamp and smoking the surfaces. The touched places are filed down, and the smoke has none of the effects that grease has in making a file slip.

If a snooper wishes to find out how much or how little real grace there is in a glass mold maker, let him go around and pass his inquisitive fingers over some nice just filed work of the latter. Unless the mold maker is asleep the unsophisticated feeler will probably hear the riot act read in five languages.

After surfacing the two pieces like *A*, Fig. 4, the dowel pins *a a* are put in (tapering).

Then make a prick punch mark as near center of opposite ends of pieces *A* as convenient when together, and draw a line

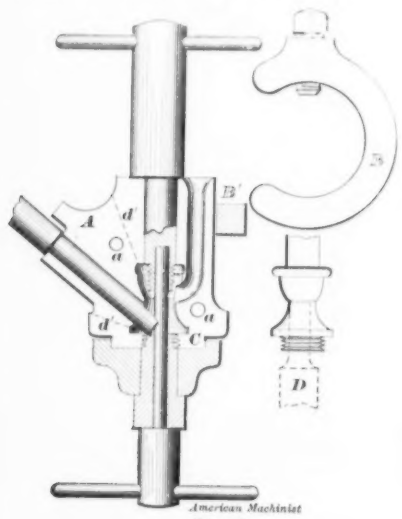


Fig. 4

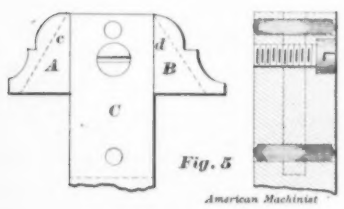


Fig. 5

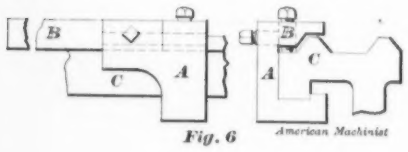


Fig. 6

from these points on each half, and file a groove on each half of the mold.

A small drill is guided by these file tracks for opening a hole entirely or part way through the center of the two pieces like *A*, the pieces being held together now, and for turning afterwards, by a clamp like *B*, left open to straddle any projection, such as *A*. Milling machines and shaper displace many such methods nowadays.

Upon taking this clamp *B* off, it may be found that the drilled grooves are unequal in depth, and, if so, the shallowest one can be filed out and both reopened equally by using a larger drill. Then a countersink with a tit is used to center the work, the groove made serving for a guide.

The work is then clamped, put on lathe centers, and turned at *C* to fit back-rest ring.

This brings us to the application of the tool shown in Fig. 2, and by looking at *D* in Fig. 4 the application to this line of work can be seen readily.

This is blind work in which the tool must furnish the contour of the work, and to do so must stand in a normal position or on the line of centers.

When made as above described the tool is turned on centers and set by the centers, which locates it correctly every way without squaring up from the face of work or lathe face plate, etc.

When the work is to be examined the ring *B* is removed, back rest moved off and sides *A* separated. For any further work it is clamped with tool *D* inclosed and back rest replaced.

A great amount of inside work, especially in glass mold making, will admit of the use of a tool like that shown in Fig. 5, where a split holder *C*, in connection with two dowel pins and a screw, secures a flat blank for single tool like *A* or double one like *A B*. The form can be turned on centers or filed out by hand, the cutting edges being brought to plane of centers by milling or filing off near cutting edge, as seen at *c d*. This leaves the cutter strong, and with *C* supported by any convenient rest a counterbore effect can be obtained.

In Fig. 4 the dotted lines *d d'* show how vents or small grooves are made for the air to escape; otherwise it will sometimes make bubbles in the casting. Being very small, the metal will not enter them to any serious extent.

The pair of stops (right and left hand), Fig. 6, can be used to good advantage in conjunction with the boring tool. *B* is an extension bar, which can be used and removed when the carriage is run back and returned without resetting.

Having set the boring tool spoken of by the set screw shown in the collar, then these solid stops can be used against the lathe carriage, and the set screw on collar loosened, and the gage screw in the same moved back instead of being brought against the face of work in motion.

LETTERS FROM PRACTICAL MEN.

Tempering Steel.

Editor American Machinist:

Mr. Simonds, in his article on scientific tempering, says: "Cherry red at best is a vague term, meaning one thing to one workman, another to another." Now, I will admit that the Minnesota man has the advantage of the Eastern man, as choke cherries are about the only cherries raised up there, and they are very near black. It is true that long experience alone has taught temperers to judge approximately at what heat steel containing various proportions of carbon must be hardened, but I have not realized the uncertainty of this method. I worked on edge tools for four years constantly, and I know that I did not lose five dollars worth during that time by having too high or too low a heat for hardening or forging. I do not know what way some of our edge tool works have for heating their steel for hardening, but I do know that the difference in their tools is great, and yet a number of them use the same make and grade of steel. During the four years I worked on edge tools I had nothing but the ordinary forge, 48 inches in diameter, and I built my fires to suit the work I was doing; about the longest piece I hardened or heated to harden on the forge was 36 inches, which can be done very nicely on a forge 48 inches in diameter.

One of the drawbacks the tool smith has with many of our firms is that they will not make it an object for him to do good work, nor have the surroundings of a tool fire as they ought to be. One of the first things that ought to be looked after is the light, for it is impossible for the smith to get the same heat every time unless he has the same light. This can easily be arranged, and at a small expense, by hanging a set of black curtains on the ordinary window curtain rollers all round the forge and tempering bath, so that they can be lowered whenever the smith has hardening to do. By doing this he can have the same light, sunshine or rain, and unless he is color blind he can get the proper heat.

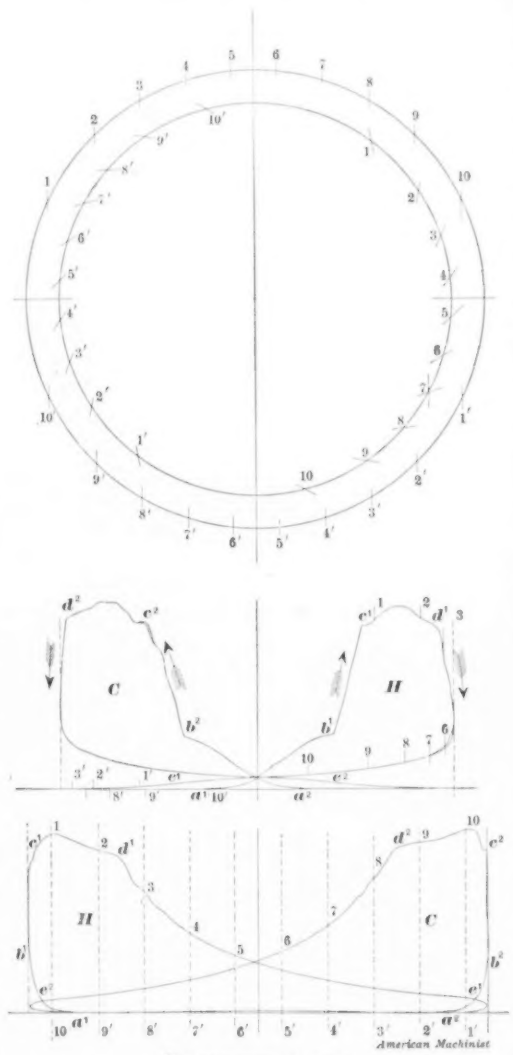
Now, the heat is not the only thing that needs care in hardening edge tools, especially in regular shapes. The fuel that is used for heating will very often cause a tool to crack in hardening or the bath you quench it in, and the way you quench it. Also the length of time it lies in the fire after you get it up to the proper heat. I don't believe that you can heat a piece of high carbon steel to the proper heat for hardening and keep it at that heat for two hours without injuring the steel, yet I will admit that different kinds of fuel will show different results, but unless you cover it as nearly air tight as it can be covered, you will injure the steel, especially the cutting edges. W. G. LOTTES.

Madison, Wis.

Those Eccentric Indicator Diagrams.

Editor American Machinist:

I am inclined to wish that Mr. S. A. Smith had been otherwise employed, instead of taking those eccentric indicator cards, because they have given me a lot of trouble. "Satan finds some mischief still for idle hands to do;" and the mischief done in the world gives the good people of the world lots of employment, and I have had quite a time of it in trying to find out the true inwardness of those cards. They look bad enough, and they are much worse than they look. I can never be too thankful that Mr. Smith did not give us the lengths of connecting rod and eccentric rod, so that I was not deprived of a good excuse for ignoring the malignant effects of their angularity. It was providential that the correct diagram



ECCENTRIC CARDS.

was given with the eccentric one, because without it I would not have been able to make out anything. First of all I cut the cards out, and pasted them on a paper, so that the centers of them came in line, and I drew the ten ordinates on the lower card in the regular way. The diameters of the two circles above are equal to the lengths of the two cards, and on the larger circle I found by perpendiculars the crank positions corresponding to the piston positions indicated by the ordinates, and I numbered all the crank positions the same as the piston positions. I used only the diagram marked *H*, of each pair, and I went repeatedly over each of them, measuring the vertical hight, until I could find some point common to both that would do for a starting point for the positions of the eccentric. The point on the expansion line of the lower card cut by ordinate No. 7 seemed to be the best point to use, so I took the vertical hight of that, and then on the expansion line of the upper card I found the point where the vertical hight was the same, and I marked that 7, the same as the other. A perpendicular from that up to the smaller circle gave me the point 7 for the position of the eccentric. Setting the dividers to the distance from the crank position 7 on the large circle to the eccentric position 7 on the small circle, I then measured the same distance from all the other crank positions, and marked them off on the small circle for the several corresponding eccentric positions. Drawing perpendiculars from those points on the small circle down to the eccentric card, I then located all the positions on that card corresponding to the positions of the same number on the lower card. I say all the positions, but some of them came so near the end of the card that they could not be located so as to mean anything. Nos. 4 and 5 on the right-hand end and 4′, 5′, 6′ and 7′ on the left end were no good. The same vertical lines would not do service for both the upper and the lower lines of the card, because those represented by the same figure would not come vertically opposite each other; 8 and 8′ are at opposite ends of the card, and none of the pairs of corresponding numbers seem to have anything to do with each other. This made me give up trying to find any way of using the card for computing the horse power. The card, however, is something more than a mere curiosity on account of what it shows us of the operation of compression and of steam admission. The admission line from *b′*, where the compression ends, up to where the piston starts off, is shown to take 10 degrees of the shaft revolution, while a card taken from the piston movement will not tell us anything about this. It would be interesting to compare this card with one in which the steam admission occurred a little earlier, so that the compression and the admission lines would form one smooth curve, and the sharp corner at *b′* would be got rid of. That *b′* corner would be the best place in the world to look for a thump in the engine, if it happened to possess such an article, and that sharp corner also suggests that the correct adjustment of the lead is a very delicate operation, and one in which minute accuracy is quite important.

TECUMSEH SWIFT.

Petroleum Carriages.

Editor American Machinist:

I have been considerably interested in the articles on bicycle construction, and especially in the wood rims. I have never, to my knowledge, seen a wooden rim on a bicycle since the original 1868 boneshaker gave way to the steel machine, and for over 20 years all rims have been of steel. It is possible that in this question of wood rims it may prove to be one of the things which, as Mr. Clough says, do not work on this side as they do on your side, and I would caution any one against expecting too much from wood wheels here, as I should think it possible that there is often more moisture in the atmosphere than would be good for a wooden rim, and that the saving in weight by the use of wood must be so small, as compared with light crescent steel, as to be inappreciable. There is no wood at all in bicycles made on this side, unless it be in the saddle, and it is doubtful if wood rims would be successful here, unless they have been proved so by trial already. The rolling of bicycle steel is quite a special branch in Sheffield, and the business in vehicles generally is likely to be good in the near future. Petroleum carriages are to the fore. One of the French vehicles now in the possession of an Englishman at Datchet has traveled by road from Paris *via* Southampton to Datchet and thence out west to Gloucester, nearly 150 miles from Datchet. A journey of 120 miles was run for less than $2.40 in petroleum and lubrication, or for less than 2 cents per mile, which, with two passengers only, is less than half railway fares. These carriages are now so common in France that horses do not take any notice of them. In America, with cheap fuel for the Daimler motor, they should be still more popular; but a blue barrel of ordinary lamp oil costs

nearly $6 in England, and the gasoline will be in proportion. What we need badly here, as soon as the law is amended, is a power-driven bicyclette. Now that every one here can ride or has at some time ridden the cycle, there would be no difficulty with such a vehicle or with a Daimler tricycle.

There is an unlimited field for the use of petroleum carriages in England, and it only awaits the abrogation of a law that was made for an entirely different purpose, and before even the gas engine had been made a practical fact. W. H. BOOTH.

London, Eng.

Tapering Worm Wheel in Milling Machine Centers.

Editor American Machinist:

Recently a question came up regarding the accuracy of the dividing head for a pair of milling machine centers. This head has the usual index plates, worm and wheel. The worm is tapering, and is provided with lengthwise adjustment for taking up wear between itself and the wheel.

Some gears cut on these centers had different thicknesses of teeth which varied in a regular manner, beginning, say, with a thick tooth, and gradually growing thinner, then back again to the original thickness. These series of thicknesses followed each other around the gear. The operator was blamed for carelessness, but investigation showed that a true gear could not be cut on these centers. (Similar gears were afterward accurately cut upon an old pair of centers having different means for taking up the wear between the worm and wheel.)

A blank having twice the number of teeth contained in the worm wheel was cut on another pair of centers of similar design, and had alternately one thick and one thin tooth. By changing the position of the blank one-quarter turn with reference to the wheel the teeth were cut nearly even.

The trouble seems to be in the tapering worm. This may be likened to a rack which instead of having its teeth of uniform thickness, measured on a line parallel to the axis, has thinner teeth at the smaller and thicker teeth at the larger end of the worm. This makes the distance between the first point of contact, at the larger end of the worm, and the center line between the worm and wheel, less, compared to the number of included threads, than the distance between any succeeding point and the same center line, measured at equal distances from the axis of the worm. We have therefore a crowding effort in an angular direction of the wheel and blank, which is greater at one part of the revolution of the worm than in any other, with a corresponding discrepancy in tooth thicknesses.

Have any of your readers had similar experiences with this device? It does seem, judging from the experiences of the last few weeks, that the tapering worm is wrong in principle when used in a dividing head.

WM. SANGSTER.

The Flooding of Steam Coils.

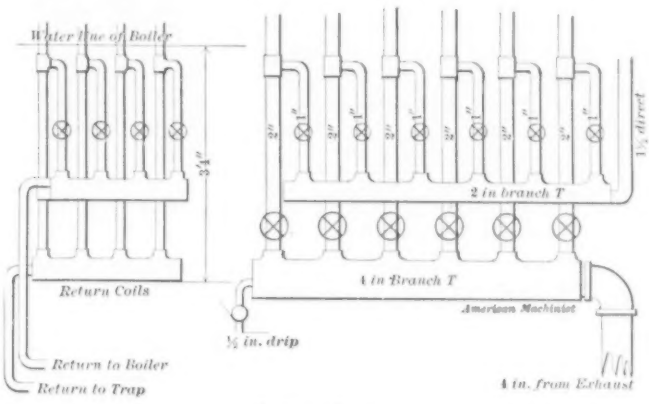
Editor American Machinist:

Having been a constant reader of your valuable paper since 1880, had a complete file of them, and used them as reference books, and obtained a great deal of valuable information from them, I would like to submit the following sketch and question:

I have just advised and have had put in the above illustrated heating system in the factory in which I am employed, and the engineer complains that he cannot return all four of the returns—direct steam only—at once without choking or flooding the pipes. You will notice that there are six directs; two are for the part of the building which is too low, and are trapped out of the building into a well; the other four are for two floors, two systems to each floor; the *lowest* is *12 feet above* the boiler. Why should the upper floor flood the lower; is not 12 feet sufficient fall? When we let the direct out of doors the steam returns almost instantly, which shows that the coils are not choked in any way; taking one at a time and then all together they seem to work well enough in the day time, but in the morning early, when first heating up, why should they act badly, or do they? The exhaust works very nicely; the 2-inch pipe runs direct to each system, which I think is ample. Would a check in the two lower systems help?

Hudson, Mass. CHAS. M. HOUGHTON.

[The trouble in this case, as our correspondent describes it, seems to be clear enough. When the live steam is first turned on, the pipes being cold, the steam is condensed rapidly, and a large volume accumulates in the pipes, while probably considerable time elapses before the full boiler pressure is realized in the coils. The dependence seems to be upon gravity alone for the return of the water, and as a hight of 12 feet of solid water only means about five pounds pressure, of course a very little difference in the steam pressure will retard or stop the flow. We do not see where check valves could be placed to help the case.—ED.]

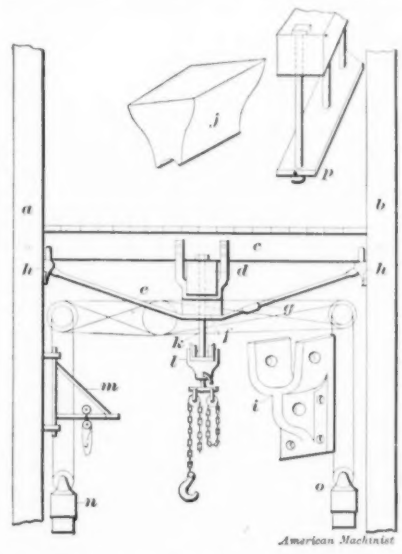


STEAM COILS.

A Narrow Machine Shop.

Editor American Machinist:

Something very good in the way of arranging a long, narrow machine shop is illustrated by sketch herewith. The building is of the ordinary frame variety, two or three stories in hight, and having the heavier machine tools upon the lower floor. A cross-sectional view is shown in the engraving, the posts *a* and *b* supporting and forming the side walls. The floor beams *c* are framed in in the usual manner and supported down the center by the long timber *d*, which is hung up to them as shown, a strapped iron being applied to every third or fourth floor joist. The beam in turn is supported by the truss rod *g*, which is attached to timbers *a* and *b* by the castings *h h*. Another casting *f* is interposed between the rod and the longitudinal girder *d*. A turn buckle is placed in the truss rod, so that the floor above may be adjusted as necessary. The longitudinal girder *d* is built principally to form a base for the trolley *l*, which runs the whole length of the shop.



As shown in the detail drawing at *p* the foundation for the trolley is a piece of flat bar iron 4 inches wide by 1 inch thick, suspended from inch bolts, placed 2 or 3 feet apart as shown. These bolts pass up through the girder *d*, and the nuts can be adjusted both above and below so as to keep the track *l* straight and level. The bolt *k* shows the method of suspending the trolley track. A novelty in this arrangement is the shoe *h* by which the truss rod is attached both to the posts and to the floor joist immediately under which they come. A detailed view of this casting is shown at *i*. It will be noted that it can be bolted both to the floor joist and also lag screwed or bolted to the side timber *h*. A large hole in the web of this casting is for attaching the truss rod, which may be made either with a forked head or merely attached to one side of the casting.

The trolley carriage is made in the usual form and carries a differential hoisting rig which will pick up anything under four tons. This affair has no lateral motion, but it is supplemented by small cranes, one placed over each large lathe as shown in the engraving at *m*; *n* and *o* represent the location of lathes, and they are belted downwards from counters placed immediately over them, on each side of the shop. The main line shaft is placed at one side of the girder timber as shown at *y*. Both open and cross belts run direct from main line shaft to counters, and the shifting being done upon these long belts makes the work very easy, and the belts last a long time.

Between the longitudinal girder and the truss rod is interposed a casting *f*, shown in detail at *j*. This casting is about 4 inches square, and is located as shown in sketch. Grinding rings are attached to each lathe, and taken as a whole the shop is very economically arranged and a good deal of heavy work can be done in it without discomfort to the workman or delay to any of the machines. JAMES F. HOBART.

That Kane-Pennington Motor.

Editor American Machinist:

In the description published in your columns of the Kane-Pennington motor, I find some statements that either need an explanation or a correction. If the two-spark mechanism has doubled the efficiency of the motor, and the consumption of oil is $\frac{1}{10}$ of one gallon per indicated horse-power per hour, as is stated, I fail to see how the claims for the ignitor are substantiated, or where any beneficial results are obtained, for if the efficiency of the motor is increased, the consumption of oil should be correspondingly decreased. Almost any manufacturer of gas engines is ready to guarantee his engine not to consume more than $\frac{1}{10}$ of one gallon of oil per brake horse-power per hour. If the two-spark mechanism has done what is claimed for it, then the motor certainly could not have compared very favorably with other makes on the market before this device was applied to it. Your correspondent also credits Mr. Pennington with the statement that the explosion does not take place until the crank angle is 45 degrees. If such is the case, it is contrary to the best practice, for you would then compress the mixture in the cylinder and allow it to partially expand before igniting it. This would not only reduce your initial pressure, but would only allow the pressure obtained by the explosion to act on the piston for the remainder of the stroke, instead of the whole of the stroke, as in all other makes. It is customary to make the spark in the cylinder before the piston reaches the end of the inward stroke, so as to have the greatest pressure at the beginning of the outward stroke.

IRVING LONGENECKER.

55 Callahan Bank Building, Dayton, Ohio.

Preparing Borax for Brazing.

Editor American Machinist:

Please allow me to suggest to "Old Brazer," in October 24th, that in preparing his borax if he will put it in any convenient water-tight dish with about an equal amount of water, place it over his fire until the borax is well melted, then stir it as it cools and thickens, he will have the finest calcined borax he ever used, and it will lay to its work much better than dry borax. I am sure after one trial he will never use the fire shovel again. By this process no pounding or grinding is required.

SIXTY YEARS IN THE SHOP.

An Exploding Piston—The Mechanical Reporter.

We reprint the following, verbatim, from the Boston *Journal*:

BROCKTON, Mass., Nov. 15.—George Bailey, a machinist, employed by Chas. H. Holt, was severely injured Thursday afternoon by an exploding piston head that he was trying to remove from a boiler. He was thrown to the ground and sustained a fracture of the right arm, broke his forefinger and suffered a compound fracture of the left thumb. He was also badly burned about the face and eyes.

We are indebted to Mr. Holt for the very clear and interesting account below:

Editor American Machinist:

The accident to George Bailey in my employ was caused by the explosion of a piston of a 7-inch by 14-inch Exeter engine. I had told him to put a new rod in the piston as the old one was badly worn. He removed the piston and rod from the engine, and as the piston was riveted on to the rod he put it in the lathe and turned out the end of the rod and then tried to drive it out; but as the rod did not start he took it to the forge to heat and expand it to get the rod out. He supposed the piston was solid, but it happened to be hollow, and in some way got some water in it and there was no vent for the steam to escape, and when the piston became hot it created such a pressure of steam that it caused an explosion with such force that it threw Mr. Bailey on the anvil behind him and broke a bone in his right forearm and right hand and the thumb of his left hand, throwing the fire from the forge, setting his clothes on fire and the shop, burning him quite badly. I should think the piston would hold two-thirds of a pint of water. C. H. HOLT.

[The above will go far toward explaining a number of other "mysterious" piston explosions that have occurred at different times.—ED.]

One hundred and twenty thousand dollars was the fee paid to Prof. E. A. Fuertes, of the College of Civil Engineering, for his work in planning for the city of Santos, Brazil, a sanitary system, where deaths from yellow fever, etc., averaged 205 to 1,000 annually. This is the highest fee ever paid to an engineer. Under him are 50 to 60 engineers; he has also employed a large number at Cornell University to draw up plans from his specifications. Never was so immense a project placed in one man's hands, for it practically means that the city shall be pulled down and rebuilt on sanitary principles. It will cost the Brazilian Government from two to three million dollars.

Near Delphi, Indiana, a marsh was recently plowed by steam. The engine used was of the ordinary traction type. The front wheels were 2 feet wide and the back wheels 4 feet in width. The uncommon width of the wheels is for the double purpose of rolling the ground, and making it solid to prevent the engine (which weighs 5 tons) from sinking into it. One engine can draw five plows. By means of a drag and roller attached to the hinder part of the plows the ground is made ready for the seed as soon as engine and plows have passed.

Mr. Edgar C. Seebohm, who has for several years represented the J. A. Fay & Egan Co., of Cincinnati, Ohio, at New Orleans, has been chosen as one well fitted to represent this firm in South Africa. Mr. Seebohm goes to Johannesburg to take charge of their interests there.

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☞ *Every correspondent, in order to secure attention, must give his full name and address; not necessarily for publication, but as a guarantee of good faith.*

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Neglected Possibilities of the Modern Machine Shop.

Probably every man has wished that he could build a house, but no man builds a house that he does not straightway wish that he might build another to correct the mistakes of the first. So it is with the building of shops. Every machinist is given to planning and imagining, and very few there are who could not at least tell us how different they would have things if they could have the designing and the arranging of the details of the shop. One who is permitted to build a new shop is to be regarded as a privileged and fortunate person, yet when the shop is built the universal experience is repeated. The man who has designed and built it regrets that he did not build it differently, and every one who sees it is a critic who also wonders why in some respect or other it is as it is. It will be seen that if we lapse temporarily into the almost universal habit we are not without justification.

In the building of our modern shops the modern materials of construction are quite generally employed. Steel beams and trusses and columns of iron or steel have quite largely superseded wood for flooring, framing and roofing, and our shops are now built stronger, lighter, more nearly fireproof and more lasting than of old, although in the lasting quality some of the old shops were sufficiently strong. The possibilities that the new construction has carried with it for promoting the general mechanical purposes of the erection we are confident have not been fully appreciated and appropriated.

The ideal machine shop is, of course, the one-story shop, and in the one-story shop of modern construction the columns and the roof trusses have been put to special service generally for two purposes only, that of carrying the necessary shafting and the supports for the traveling crane.

In many shop designs the traveling crane has been the supreme idea to which everything has been subordinated, and no one need travel far to find those who believe that the traveling-crane idea has been in some cases overdone. While certainly all the traveling cranes are not in use that should be, we doubt not that there are many that may be regarded as a poor investment. But when we have our traveling crane and our line shaft all up any one can look in and say that we have a fine factory building that may be used for almost any manufacturing purpose, and nothing about it particularly suggests the machine shop to the exclusion of other industries. A modern foundry has a functional character and is readily recognized for what it is and as especially adapted to its specific purpose, but not so the machine shop.

If any one will look over the equipment of a large machine shop, and if he will for a time overlook the lathes and direct his attention to the variety of other tools employed, he must notice one feature that is common to a large portion of them. Excluding the lathes in the shop, how many tools are there that do not comprise, as a prominent or essential feature, columns or frames or housings for holding the tools or the operating mechanism high above the floor? Why in many cases could not this function be better fulfilled by the beams of the building? Say that we have the most modern of modern shops, with the great central nave and the wings of considerably lesser hight, why should not these wings have, overhead and lower than the present ceiling, stiff beams with ample horizontal bracing in all directions capable of carrying drills and boring machine mechanism? The radial drill is probably not lower than third or fourth in functional importance among machine tools, and everything that it does can be better done by a suspended drill that is entirely independent of the floor. Boring mills for large diameters are among the most costly of modern tools; but with overhead mechanism entirely independent of that below they may be made of unlimited capacity, of greatly increased convenience of operation and for probably one-half the cost.

With a ceiling or framing overhead as stiff and strong as the floor below, there is a new and imperative demand for the independent suspended drill. The overhead drill is one of the old-fashioned tools that is not now generally met with, we believe, not on account of its inutility, but because we have got too much into the habit of buying and expecting to buy only self-contained and ready-made tools. There is probably no successful manufactory of any standard article that is not largely dependent for its success upon the special machines employed. Every machine shop has now its special lines of manufacture, and it, too, in almost every case could use its special tools, and when it comes to the designing of them it will be well to think of the possibilities that are overhead.

Commodore Melville Indorsed.

Information has been received to the effect that the German Government intends to place triple screws in three of its new second-class cruisers, and in one first-class battle ship. This is rightly regarded as a very significant indorsement of Commodore Melville's action in securing the adoption of this principle in our "Columbia"—the first large war vessel to be so equipped.

And this seems to be a good time to call attention to the fact that Commodore Melville's term of office expires next February, and that there are those who fear that his outspoken words on questions that have figured in the "line and staff" contest may result in some effort being made to prevail upon the President to decline to re-appoint him. Commodore Melville has, however, done no more than his plain duty in calling attention to the plain reasons why the engineer corps has been handicapped. In doing so he has only attempted to do what must eventually be done by himself or some one else in his position, if the Navy is not to be seriously and needlessly crippled by customs and rules which the advance in naval construction and changes in the science of naval warfare during the past twenty-five years have rendered absurdly unfitted to present conditions.

The part which the Bureau of Steam Engineering has taken in the construction of the new navy, under the leadership of Commodore Melville, has been exceedingly creditable. No work of equal importance and magnitude has, we believe, been done anywhere in either private or government establishments with fewer mistakes or mishaps, and it would certainly be a grave mistake to permit such an officer to retire from his position simply because his sense of duty has impelled him to be outspoken on matters which he believes to be vital to the highest success of his department and of the Navy itself.

Use Your Pen, Your Pencil or Your Typewriter.

Though our series of articles on bicycle manufacturing will give a great deal of information regarding the methods and processes by which such machines are made, our man cannot, of course, see and describe everything, and we wish all our new readers in bicycle factories and elsewhere to know that our columns are always open for contributions on subjects connected with shop practice.

Those who, in one capacity or another, are connected with machinery building establishments have much more to do with making the AMERICAN MACHINIST than its publishers or editors have.

The editor can be only the chairman of the meeting, so to speak, and the paper is designed to be simply the mouthpiece of those who build and operate machinery. And no paper can be more or better than the mouthpiece of those who are interested in the subjects of which it treats. We hope all our friends will feel free to comment upon or to criticise our Bicycle Tools articles, and that they will send in for publication anything they think may interest readers.

Scarcity of Naval Engineers.

Engineer-in-Chief Commodore Melville calls attention in a recent report to the fact that the Naval Academy is turning out engineers as fast as vacancies occur, and he recommends that the department be allowed to take engineers from among the graduates of Cornell, Harvard and the Massachusetts Institute of Technology.

We should much rather that the recommendation should be to take men from any school whatever, or from no school at all, who could prove their fitness for the position. The notion that no one should be allowed to even aspire to the position of an engineer in the Navy unless a graduate of a certain school is unworthy of our time, and should be gotten rid of.

There are men in the U. S. Navy classed and paid as machinists, and treated as if they were nobody, that are in reality doing all the work of naval engineers, except wearing the brass-bound clothes and drawing the money.

It should be possible for such men by showing their competence for the positions to get them. Many of them are, we firmly believe, far more competent for the positions than any school graduate can be, and more of them would fit themselves for the position if there was any incentive to do so.

A New Charge Against the Bicycle.

The latest achievement of the calamity experts is to demonstrate, to their own satisfaction at any rate, that bicycles have cost the country $200,000,000 during the past four years, or $50,000,000 a year. The cost to manufacture these is put at $27 each, and they say that actual values will tend toward this figure, and the shrinkage in values from $200,000,000 to $75,000,000 or less will affect Wall Street and make trouble in financial circles.

Of course, there could be no more ridiculous nonsense, but it answers the purpose of helping to produce a "scare," perhaps. These machines have been sold and paid for, and the application of a little common sense to the matter would show that their depreciation in the hands of users is no more a serious matter than is the wearing out of clothes or shoes, either of which cost much more than $50,000,000 per year.

A new demand for machinists seems to have been foreshadowed by some occurrences during the recent election in New York State where one of the new ballot machines got out of order during the day, and the business of saving the country had to be suspended until an expert could be brought from the factory to put it in working order.

It is not unreasonable to suppose that the time may come when an expert machinist will be stationed at every polling place to insure that no mishap shall result in the disfranchisement of qualified voters. Such a machine man would certainly exert a much more wholesome influence upon elections than some of the other kind of machine men who now have so much to do with them.

We are pleased to note that *The American Engineer* has fallen into line of the movement for standard size catalogs, and in each notice of a new catalog gives its size and states whether or not it is "standard." We have been doing this for some months, and think the results have been good. We hope all technical and trade papers will eventually follow the same practice.

The reported capture of large orders for armor plate by the Bethlehem Iron Company and Carnegie, to be used on Russian naval vessels, is attracting considerable attention in armor-plate manufacturing and naval circles all over the world, and it is thought to indicate that American armor-plate mills will have to be dealt with in any open competition for such work that takes place hereafter.

Frederick Baldt, manager, and James T. Anderson, foreman of the Penn Steel Castings Co., of Chester, Pa., were on the 20th inst. acquitted of a charge of attempting to defraud the government on a contract for steel castings. Three naval officers were the witnesses for the government, and no witnesses were examined for the defendants for the reason that those conducting the prosecution utterly failed to make out a case, the judge declaring that the testimony given was not sufficient to establish even a well-grounded suspicion of guilt, much less a proof of it.

Barton Hoopes, founder and head of the firm of Hoopes & Townsend, of Philadelphia, died the 15th inst. He started the manufacture of bolts, nuts, etc., in Wilmington, Del., in 1849, and removed to Philadelphia in 1852. He was 69 years of age at the time of his death.

Can any of our readers give us information about the process of etching names or designs upon steel by the use of a rubber stamp?

Literary Notes.

THE PRACTICAL APPLICATION OF THE SLIDE VALVE AND LINK MOTION TO STATIONARY, PORTABLE, LOCOMOTIVE AND MARINE ENGINES, WITH NEW AND SIMPLE METHODS FOR PROPORTIONING THE PARTS. By William S. Auchincloss, C. E., M. Amer. Soc. C. E. Thirteenth Edition, Revised. New York: D. Van Nostrand Company, 1895.

The preface to this revised edition of Auchincloss says that "'Link and Valve Motions' has had a phenomenal sale during the past twenty-five years." The book itself was a phenomenon, as every engineer knows. We cannot think of another book pertaining to engineering, however complete and thorough it may have been, which from the moment of its appearance was accepted as a standard work and could hold that position unchallenged through so many years. In the present edition the author says that he "has carefully eliminated all abstruse formulæ, because he considers it absurd to invoke the aid of higher mathematics for the solution of every-day problems in link and valve motion." The Allan and the Welschäert link motions are here considered much more fully than in the previous editions. We regret to note that the book has no index. Price, $2.

THE PRACTICAL APPLICATION OF DYNAMO-ELECTRIC MACHINERY. By Carl K. MacFadden, Associate Member American Institute Electrical Engineers; and William D. Ray, Associate Member American Institute Electrical Engineers, Vice-Pres. Chicago Electrical Association.

The reader of this little book who realizes the need of a general fundamental understanding of the application of electricity, will find much which will be beneficial, instructive and interesting, and will place him on such a foundation as to make the other, more complete electrical books more easily understood. The whole subject is presented in a very simple manner, free from technicalities; the electrical terms which have to be used are thoroughly explained, and such illustrations given as to make the book a very suitable one for beginners. The first chapter treats on elementary data, and the following chapters treat on magnetism and induction, theory of dynamos, current distribution, transformers, types of dynamos, causes of trouble in dynamos, arc lamps, electric motors, storage batteries, electric heating, horse-power equivalents, and copper wire data.

The book is published by Laird & Lee, Chicago, Ill. Price $1.00.

The Horseless Age is the rather negative name of a new journal which, in character and appearance, is, however, positive enough, and is devoted to matters connected with the motor vehicle industry, the initial number containing illustrated descriptions of a large number of such vehicles, good, bad and indifferent. The new journal is well illustrated and printed, and is published by E. P. Ingersoll, 157–159 William Street, New York.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet. We cannot undertake to answer questions in "next issue." This department is usually crowded, and questions must wait their turn to be answered. Neither can we undertake to solve mechanical or engineering problems, and send answers by mail.

(414) A. V., Greencastle, Pa., writes: Please give me the address of the publishers of a good practical book useful to machinists, engineers and patternmakers. *A.*—See "How to Study and What to Study," in answer to Question 539 in our issue of November 22, 1894.

(415) W. R., Pittsburg, Pa., writes: Please let me know what the rated horse-power will be of an engine with cylinder 14 inches diameter, 18 inches stroke and running at 120 revolutions per minute. *A.*—We should rate it at 63 indicated horse-power, non-condensing.

(416) J. E. S., Pittsburg, Pa., writes: Please inform me of a good work treating on the making of all kinds of lacquers for bronze and chandeliers. *A.*—We do not know any book treating exclusively on this subject. You will find the information in some of the cyclopedias of recipes, notes, etc.

(417) E. P. S., Burlington, Iowa, writes: Kindly inform me of the most modern works now published treating on the gas and vapor engines, and where the same can be secured. *A.*—"Gas Engine," by D. Clerk, we believe to be a good book. In studying the principles on which these engines work, we should advise you to get "Thermodynamics, Heat Motors, and Refrigerating Machines," by De Volson Wood, third edition. Both of these books are published by John Wiley & Sons, 53 East Tenth Street, New York.

(418) G. M. T., Tottenville, N. Y., writes: I have a round piece of sapphire set in a brass block. I wish to increase the hole through the sapphire from .034 to .036 diameter, and give it a very high polish. I have used diamond dust, but I do not know positively what to mix with it. *A.*—We should use wire or wood lap, charged with diamond dust moistened with olive oil. 2. Kindly give me the title of a good book which treats on the working of precious stones. *A.*—We have not seen a book of this kind.

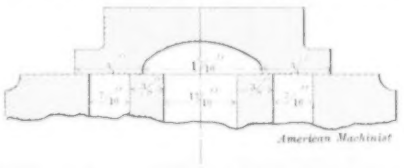
(419) S. T. W., Baltimore, Md., writes: Kindly inform me where I can find cuts and descriptions of the Marshall & Joy valve gears. Also, are these gears patented or have the patents expired? *A.*—The Marshall valve gear you will find illustrated and described in our issue of July 18th, page 6, 1889. The Joy valve gear has been illustrated in answer to Question 433 in our issue of November 13, 1890. You will also find illustrations and descriptions of these gears in "Valve Gears for Steam Engines," by C. H. Peabody, published by John Wiley & Sons, 53 East Tenth Street, New York.

(420) R. S. B., New Britain, Conn., writes: A number of castings have the appearance of malleable iron, but are claimed by the makers to be cast steel. What chemical or physical test will settle the matter? *A.*—Any one familiar with malleable iron can recognize it by the fracture. When broken it will show a skin of more or less thickness of fine grain and quite white, while the interior will be of quite a dark color and more or less rotten in appearance. A steel casting when broken will show a practically uniform granulation over the whole surface. The steel casting looks like steel in the fracture, while malleable iron decidedly does not.

(421) S. H., Prono City, Utah, writes: Please inform me how many gallons of water will be discharged per hour through a 4-inch pipe 9,000 feet long with 200 feet fall. *A.*—The quantity discharged will depend on the smoothness of the interior of the pipe; if smooth and uniform in diameter the discharge will be about 9,182 gallons per hour. 2. How many gallons per hour will this pipe discharge with a fall of 30 feet? *A.*—About 4,600 gallons. 3. Would you advise the same diameter throughout the whole length of pipe? *A.*—If all the water is discharged at one end we should use the same diameter of pipe throughout the whole length.

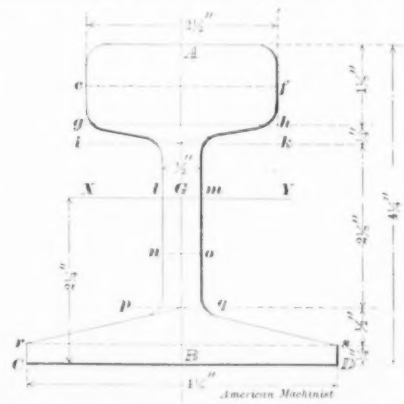
(422) F. E. W., Springfield, Ohio, asks: Will you please give an explanation of what is meant by "foot-pounds"? We have had some discussion in regard to the term, some claiming that time and energy or power applied are both taken into consideration, while I claim they are not. Please state which is correct. *A.*—The term "foot-pound" means one pound weight lifted 1 foot high, and the element of time does not enter into it, as it represents a foot-pound of work done, whether the time consumed be one second or one year. But when time is also considered, it then becomes a question of power, and if the weight of 1 pound is lifted 1 foot *in one minute*, then $\frac{1}{33{,}000}$ of a horse-power has been exerted during that time, simply because a horse-power is equivalent to lifting 33,000 pounds 1 foot in 1 minute. If we know that 33,000 pounds have been lifted 1 foot, we then know that 33,000 foot-pounds of work have been done. But this work might be accomplished by an engine the maximum power capacity of which was only $\frac{1}{10}$ horse-power, only it would have to be geared up so that it could handle the weight, and neglecting the extra gearing required to overcome friction, would have to run 10 minutes to do the work, while a 1 horse-power engine could be geared to lift the weight faster, and would need to run only 1 minute to do the work.

(423) "Engineer," ——, writes: I send you sketch of valve, and would like your opinion as to the best way to increase the efficiency of the engine. The engine is an upright, 5 inches by 8 inches, and the valve takes its motion from the crank pin by means of an arm on which is fastened the valve pin, so arranged as to admit of adjustment and also permit lengthening or shortening of the travel of valve. As the engine is now running the valve has a travel of $1\frac{1}{16}$ inches, but



does not give as good results as it is thought it should. *A.*—We would cut out the exhaust cavity of the valve to $1\frac{1}{8}$ inches, and increase the travel to $1\frac{1}{4}$ inches. After that to add $\frac{1}{8}$ inch to the outside of the valve at each end, either by making a new valve or otherwise, and then increase the travel to $1\frac{1}{2}$ inches would be a good thing. The valve should, of course, be set with proper lead after either change. The changes suggested will neither of them increase the actual power developed by the engine, but they will tend to promote the efficiency of the steam used, although in so small an engine it will probably be difficult to demonstrate much improvement.

(424) J. J., Birmingham, Ala., writes: We have some heavy weights to lift, and in connection with this a question came up in regard to the carrying capacity of a steel rail of the following dimensions: The head is $2\frac{1}{2}$ inches wide, the stem is $\frac{1}{2}$ inch thick, flange $4\frac{1}{2}$ inches wide, and the hight is $4\frac{1}{2}$ inches. Please give rule for computing the load it will carry, and work out the problem as simple as possible. Distance between supports is 64 inches. *A.*—To work out a problem of this kind we should have a section of the rail with all dimensions marked upon it; since you have not given this section we shall assume that it is like that shown in the accompanying figure. The neutral axis passes through the center of gravity of the section; hence our first step will be to find the center of gravity. For this purpose, divide the section into a number of elementary figures by the lines *e f*, *g h*, *i k*, *l m*, *n o*, *p q*, and *r s* drawn parallel to the base line *C D*; find the area in square inches of each elementary figure, and multiply each area by the distance in inches from the base line to its center of gravity, add all these products, and divide the sum by the whole area of the section; the result will be the distance from the base line *C D* to the center



of gravity *G* of the section; we find this distance to be very nearly $2\frac{1}{4}$ inches, hence through *G* draw the line *X Y* parallel to the base line *C D*; the line *X Y* will be the neutral axis. The next step will be to find the moment of inertia of this section; this is done by multiplying the area of each elementary figure as previously found by the square of the distance from its center of gravity to the neutral axis; add up these products; the result will be the moment of inertia of the section. This result is an approximate one only, but the nearer that the division lines *e f*, *g h*, *i k*, etc., are placed to each other, so that there will be a greater number of elementary figures, the closer to the correct result will be the approximation. By the method indicated, we find the moment of inertia to be 16. We shall now assume that the whole load is concentrated at the center of the rail; to find the safe load which the rail will support under these conditions, we have the following rule: Multiply the safe working stress in pounds per square inch by the moment of inertia, divide this product by the distance in inches between the supports and by the distance in inches from the neutral axis to fibers most remote from it, and multiply the quotient by 4; the result will be the load in pounds which the rail can support. In symbols we have:

$$W = 4 \times \frac{S \times I}{l \times e};$$

in which W = load in pounds, S = safe working stress, I = moment of inertia, l = distance in inches between the supports of the rail, and e = distance from the neutral axis to the fibers most remote from it. For S we may take 12,000 pounds per square inch, I we know to be equal to 16, l is given as 64 inches, e is $2\frac{1}{4}$ inches. Substituting these values for the letters, we have:

$$W = 4 \times \frac{12{,}000 \times 16}{64 \times 2\frac{1}{4}} = 5{,}332 \text{ pounds}$$

which the rail will support with safety, provided the load is a quiescent one.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Gear Wheels, Gear Cutting. Grant; see page 952.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Engrs. should investigate the Korting Condenser. Obtain Catalog from A. Aller, 109 Liberty St., N. Y.

Marine Iron Works, Chicago, builders of steam yachts and marine machinery; catalogs free.

Squaring and Rotary Shears, Tinsmiths' Tools, Presses and Dies for sheet metal work, are made by the Niagara Stamping and Tool Co., Buffalo, N.Y.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

Key Seaters for any length of hub or width of keyway. New, handy machines. Mitts & Merrill, 913 Tilden street, Saginaw, Mich.

Three valuable books by Prof. N. Hawkins—"Calculations," $2.50; "Instructions for the Boiler Room," $2.50; "Aids to Engineers' Examinations," $2. Sold on installments. Write for terms and catalog. Theo. Audel & Co., 91 Liberty St., N. Y.

Thin emery wheels, for cutting slots, etc., a specialty. The Tanite Co., Stroudsburg, Pa.; 161 Washington street, New York; 139 East Pearl street, Cincinnati, Ohio.

"Practical Drawing," by J. G. A. Meyer; used by engineering schools in lieu of text-book; the set of 92 papers sent to any address in the United States for $5. AMERICAN MACHINIST, 203 Broadway.

As will be seen by an advertisement on page 956, "Business for Sale," an opportunity is given for one or more young men to purchase an established business in Corning, N. Y. Preston & Heennans, the advertisers, have conducted very successfully the business here advertised for nearly 30 years. The whole property is in first-class condition, and will be sold at a bargain.

A New Coal Calorimeter—II.*

By PROF. R. C. CARPENTER.

EXPERIMENTS WITH OTHER FORMS.

The methods of coal calorimetry have been the subject of almost constant experiment in the laboratories of Sibley College for the past three years, but until the past year the instruments employed were those which have been long in use; it may be a matter of some interest, however, to give a synopsis of what has been done, although it cannot be claimed that much has been accomplished.

The instruments tried, regardless of order, have been as follows:

1. Thompson's calorimeter, shown in Figs. 4 and 5. This instrument provides an approximate method of determining heat value which is often quite satisfactory with bituminous coal, but, so far as the writer's experience goes, is of no value with anthracite coal.

It consists (Fig. 4) of glass jar, *H*, graduated to contain 1,934 grams of water (twice latent heat of steam at 212 degrees). In this are inserted, 1, a thermometer to indi-

*Abstract of a paper presented at the Detroit meeting of the American Society of Mechanical Engineers.

cate rise of temperature; 2, a combustion chamber, *G*.

The combustible, 2 grams, is powdered and mixed as thoroughly as possible with 22 grams of a very dry mixture of 3 parts potassic chlorate with 1 part of nitrate, and introduced into a small copper furnace, *F*, provided with a fuse.

The furnace, *F*, is placed beneath the combustion chamber, *G*, and fired, the gases escape through holes in the bottom of the combustion chamber and rise through the water, escaping at the top, somewhat as shown in Fig. 5. In order to get a more intimate mixture of the escaping gas and water, we used baffle plates on the combustion chamber, and also very fine wire-gauze netting. Instead of firing with a fuse, we fired with an electric current.

With this instrument the rise in temperature of the water at beginning and end of experiment, in degrees, gives the evaporative power of the coal in pounds of water from and at 212 degrees, provided the water and coal are used in the proportions stated. If other proportions are used, the results will need to be worked out by the methods employed with other calorimeters.

2. Berthelot's bomb calorimeter, Hempel's modification, consisted of a very strong closed vessel, *the bomb*, in which the fuel is placed, and which is then charged with oxygen under a very great pressure (8 to 15 atmospheres). This fuel is fired with an electric spark, and the combustion takes place with great excess of oxygen. During combustion the bomb is placed in a vessel filled with water, which is kept thoroughly agitated, and the rise in temperature noted by a very delicate thermometer.

The value of the fuel burned is determined from the rise in temperature of the water, taking into account its weight, and also the weights and specific heats of all parts of the calorimeter. The latter operation is a very delicate and complicated one, requiring the utmost skill on the part of the observers, and the most delicate instruments for obtaining temperatures and weights.

The oxygen can be purchased in cylinders under pressure, or it can be manufactured as required. Hempel attached a crucible, *C* (Fig. 6), to his calorimeter, and made the oxygen as required, by heating a mixture of dioxide of manganese and chlorate of potash in equal parts. The instrument is shown, with crucible for making oxygen attached, in Fig. 6. Before making the oxygen the fuel is inserted in the calorimeter, the crucible connected, and the oxygen made until a pressure of 150 pounds is shown on the attached pressure gage. Crucible and gage are then removed, a cock, not shown, being closed to prevent escape of oxygen.

The bomb is then placed in a vessel containing water, and provided with stirring apparatus and delicate thermometers.

A section of the bomb and enlarged view of the cap, with connections for firing, are shown in Fig. 7.

A sectional view of Mahler's calorimeter, with detached battery for firing and tank filled with compressed oxygen, is shown in Fig. 8.

A form of calorimeter very much like the Mahler is shown in Fig. 9, and has recently been made by Bryan Donkin & Co., London, England.

Other instruments have been tried. One form, shown in Fig. 10, was copied from one used by Prof. Robert Smith, of Mason's College, Birmingham, in some determinations of heating values of coal. The form shown has details as arranged by C. H. Bierbaum, M. E.

The instrument is a modification of the Thompson calorimeter, but the fuel, instead of being burned in a chemical which disengages oxygen, is burned in oxygen gas under slight pressure.

It consists of a bell glass, *E*, supplied with a glass tube at top, through which pass the oxygen for combustion and also the wires for carrying the electric current for firing the fuel. The bell glass can be raised or lowered, as required, and the fuel is placed in the jar from below. The products of combustion escape through the surrounding water, as in the Thompson calorimeter, and the heating value of the fuel is determined by the rise in temperature of the water, multiplied by its weight, plus the water equivalent of the calorimeter. That, divided by the weight of coal burned, gives the heating value per pound.

Very delicate thermometers were used, and also a stirring apparatus for mixing the water. The glass vessel, *E*, permitted the process of combustion to be seen at all times, which I consider of advantage, as we found it difficult in many instruments to tell when combustion begun or closed.

Some experiments were also made on calorimeters having very large coal capacity and which were immersed in large tanks of water. One of these forms, designed by Mr. William Kent, consisted of a combustion chamber and a long coil of 2-inch copper pipe, all of which was immersed in a large tank of water during the process of combustion. This was a very promising instrument, but it was rather difficult and costly to manage, and we were never exactly sure of securing perfect combustion, with air, which had to be used on such a large scale.

The instrument which has been described has filled all requirements reasonably well, and during the past year has been subjected to such handling as would best develop its defects and determine its accuracy. In using it during the past term, the students were given samples of coal whose heating values were well known, and in this way an opportunity was presented of comparing the results of inexperienced and untrained men. Such operations were repeated day after day during the entire term, each group of two students making the proximate analysis and determining the heat value as explained. The time required for both these operations rarely exceeded half an hour, and the results obtained agreed well within the expected limits of error. The instrument can readily be read to 10 B. T. U. per pound of coal, but the accuracy with ordinary handling is probably about 100 B. T. U., or $\frac{1}{2}$ of 1 per cent.

The only difficulty that has been experienced in its use has been that due to the collection of air in the top part of the apparatus. This has in some instances been difficult to remove, and has always rendered it necessary, when first starting to use the instrument, to exercise considerable care. It seems very certain, however, that a very slight change in the top of the device will make it of such form that it will be impossible for air to remain after the pressure is applied, since it will be quite easy to arrange the open tube in such a manner that all air caught in the instrument will pass directly out through the tube.

The following table gives the results of tests made for the heat contained in 23 samples of coal, by B. T. Flory and E. M. Gilbert, two students in the graduating class, Sibley College.

It may be said that extreme accuracy is not claimed for the instrument, but our experience would indicate that it is one convenient to use, and not subject to greater errors in results than that due to the selection of sample.

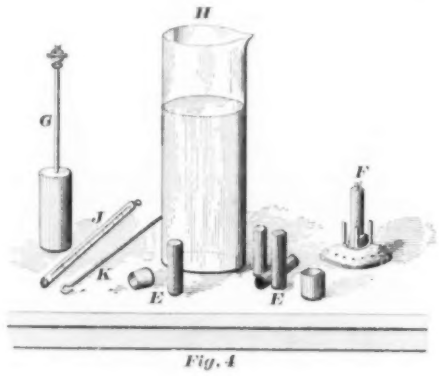


Fig. 4

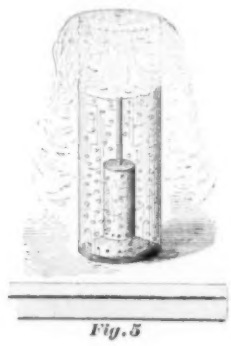


Fig. 5

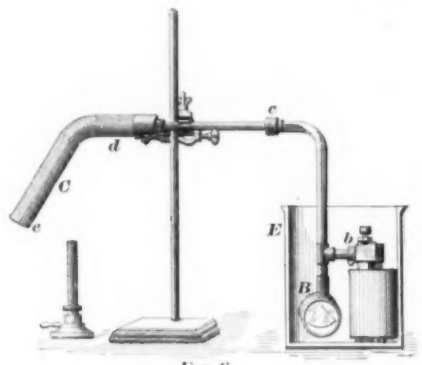


Fig. 6

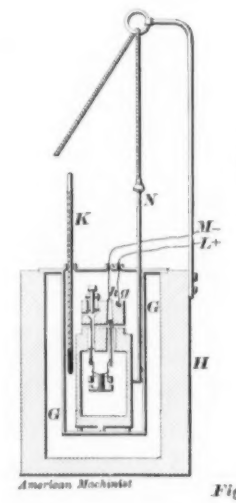
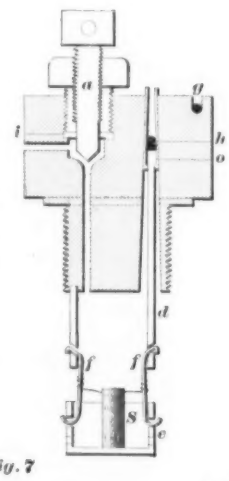


Fig. 7



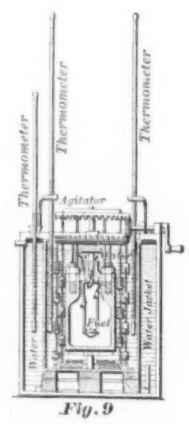


Fig. 9

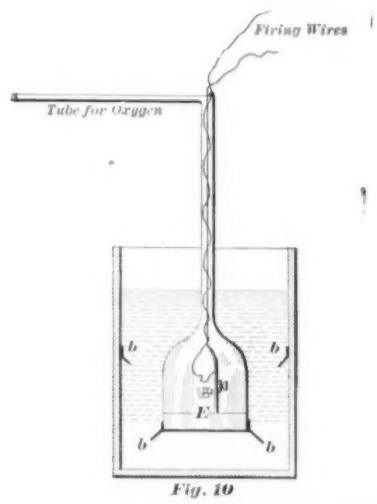


Fig. 10

A NEW COAL CALORIMETER.

NAME OF COAL.	KIND OF COAL.	LOCALITY.	No	Average moisture. Per cent.	Average volatile matter. Per cent.	Carbon. Per cent.	Average ash. Per cent.	Calorimeter. Value B. T. U.	Average specific gravity.
*Cooperstown	Bituminous	Nova Scotia	1	1.11	30.42	64.44	4.03	15.266	1.345
Bernmut Coal W'ks.	Bituminous	Monon. Riv. Pa	2	2.27	31.29	58 61	7.83	13,126	1.275
Reynoldsville	Bituminous	Reynoldsv'e, Pa	3	1.09	24.4	69.21	5.3	14,971	1 34
Nova Scotia	Bituminous	Nova Scotia Slope No. 2.	4	3.08	31.41	61.71	3 81	14,864	1.31
Pocahontas	Bituminous	Pocahontas, Va.	5	1.25	17.62	77.48	3 65	15,094	1.255
Gillespie	Bituminous	Gillespie, Ill	6	3 77	34 94	49.55	11.74	10,506	1.23
Leiseuring	Bituminous	Conn'sville, Pa.	7	1.93	28 71	63 26	6.1	15,005	1.34
Turtle Creek	Bituminous	Monon. Riv. Pa.	8	2 11	34.22	59.45	4 22	14.150	1.28
Eureka	Bituminous	Clear'd Co., Pa.	9	1.03	23.55	69.69	5 73	13,756	1.32
Antrim	Bituminous	New Blossburg.	10	1.24	18.57	69.3	10 9	13,528	1.42
Mannville Shaft	Anthracite	Scranton, Pa	11	1 04	5.95	85 7	7.31	12,934	1.42
Avondale	Anthracite	Scranton	12	1 28	5.89	86 68	6.15	13,051	1.44
L. V. Buckwheat	Anthracite	Wilkesbarre	13	1 34	6.42	76.94	15 3	11 801	1.31
Mt. Pleasant	Anthracite	Scranton	14	1 27	7 54	80.54	10.65	12,307	1 42
Oxford	Anthracite	Scranton	15	1 35	5.03	91 45	2.17	13,254	1.415
Coxe's No. 2	Anthracite. Slate removed.	Drifton, Pa	16	3.62	1.96	89.19	5 23	13,723	1.56
Coxe's No. 1	Anthracite. Slate removed.	Drifton, Pa	17	2.97	2.3	87.96	6 77	13,324	1.55
Woodward	Anthracite	Scranton, Pa	18	3.33	3 73	79.23	13.71	12.149	1.42
No. 11, Forty-foot	Anthracite	Scranton	19	1 12	4 99	83 98	9.91	12,903	1 415
Continental	Anthracite	Scranton	20	1.97	5.98	83 13	9.62	12,943	1.615
L. V. Pea	Anthracite	L. V Pea	21	1.44	7 36	75.2	16.00	12.423	1 52
Jermyn	Anthracite	Pottsville	22	1.7	5.78	71.68	10 84	12,036	1.425
Cayuga	Anthracite. D. L. W.	Scranton	23	.97	5.37	84.46	9.2	12 294	1.49

*Sample obtained from Canadian Pacific R. R.

NOTE—Oxygen can be made as described for the Hempel calorimeter, or it can be purchased, compressed under great pressure, of the New York Oxygen Company.

A Perplexing Question.

We have received from a correspondent the following question:

I put in a crank pin with four 1¾-inch bolts, 5 threads to the inch, and two wrenches 8 feet long, with four men on each wrench. The bore of the crank is 3¾ inches and the thickness 6 inches; I would like to know how many tons pressure I had on it.

Questions of this character are, of course, always welcome, and we take pleasure in answering them to the best of our ability, and as far as we can we intend to do so in the way that will best carry interest and information to our general readers. So if we take some liberty with the questions as they come to us and do not always follow exactly the line directly suggested, we trust that no one will be offended or discouraged from sending along other questions as they may arise. Any answers that we give are, of course, open to criticism, correction or addition from our valued correspondents as the cases may call for them.

In the first place, we have to examine this question a little to see that we understand every point involved beyond the possibility of a misunderstanding. As there were four bolts and only two wrenches, of course, all the bolts could not have been screwed up at once. We may assume that the bolts opposite each other were screwed up together, giving them a pull and then shifting to the alternate pair. Then we come to a point of great uncertainty as to the elasticity of the straps that were used, and it is a question that we have absolutely no means of determining how much tension would remain upon one pair of bolts when the other pair were screwed up. The pressure upon the crank pin would be the sum of the tensions of all four bolts. The wrenches,

8 feet long, may possibly have been double ended, making the leverage only four feet, but it is probably more correct to assume that the wrenches were single ended. Of course, all of the four men did not get their hands on the wrench at the extreme end of it, so that 7 feet 6 inches will be certainly as long as could be properly allowed for the effective length of the wrench. We do not know whether the bolts were in a horizontal position with the wrenches moving in a vertical plane or whether the bolts were vertical and the wrenches moved horizontally. In the former case, the men might put their whole weight on the wrenches if pulling down or more than their weight if pulling up—we might say 150 pounds for each man. If the bolts were vertical and the men had to shove or pull the wrench horizontally, the condition of the floor on which they stand would make a difference. Probably they would each be capable of exerting about 50 pounds on the wrench. The lubrication of the threads of the bolts and nuts and of the faces of the nuts where they bore against the straps or washers is another important factor in this case. Shoving a heavy weight along the bare floor is one thing, and shoving it on rollers is quite another thing, and there is just this difference between non-lubrication and lubrication, although everybody does not always think of it until they find that things will not go without the assistance of this supplementary "mechanical power." In a case like this, where the friction surfaces are subjected to heavy pressure, the kind of lubricant employed also becomes important. A very thin oil will soon squash out and is not of much use in such a case as this. Oil with considerable "body" and viscosity should be used, or stiff grease would be better still. Taken all around, the above question is delightfully uncertain, and it is well that the answer to it is asked for in tons rather than in pounds.

We will assume that only two of the four bolts are effective, and that one-half of the theoretical pressure developed is lost in friction. For one revolution of the nut the distance traveled by the end of the wrench, or, rather, of the point, 7 feet 6 inches from the center of the nut, where we have assumed the power to be concentrated, is 15 feet (diameter of the circle) or 180 inches $\times$ 3.1416 = 565.388 inches, and the distance that the nut is advanced on the bolt at the same time is, of course, one fifth of an inch or 0.2 inch; then the force applied to the end of the lever will be to that realized at the face of the nut as 0.2 : 565.388. Assuming each man to pull 50 pounds on the wrench, or 200 pounds for the four men, we have

0.2 : 565.388 : : 200 : 565,388 pounds.

As we are figuring on two bolts, the pressure on the two will be double this, or 1,130,776 pounds; but as we have assumed that only one-half of the theoretical power is realized on account of the friction, we get back again to 565,388 pounds or 282+ tons. In Meyer's "Modern Locomotive Construction" it is said that when the pin and hole are in good condition the pressure should be 6 tons for each inch of diameter, so that the above result would seem to be ten times as large as it should have been. We are inclined to think that in the above case the surfaces of the hole and pin were not properly cleaned and lubricated, and that they "seized" or "cut" before the pin was forced home. But it is not at all certain what allowance should be made for friction, and perhaps 75 per cent. would be nearer right than 50 per cent.

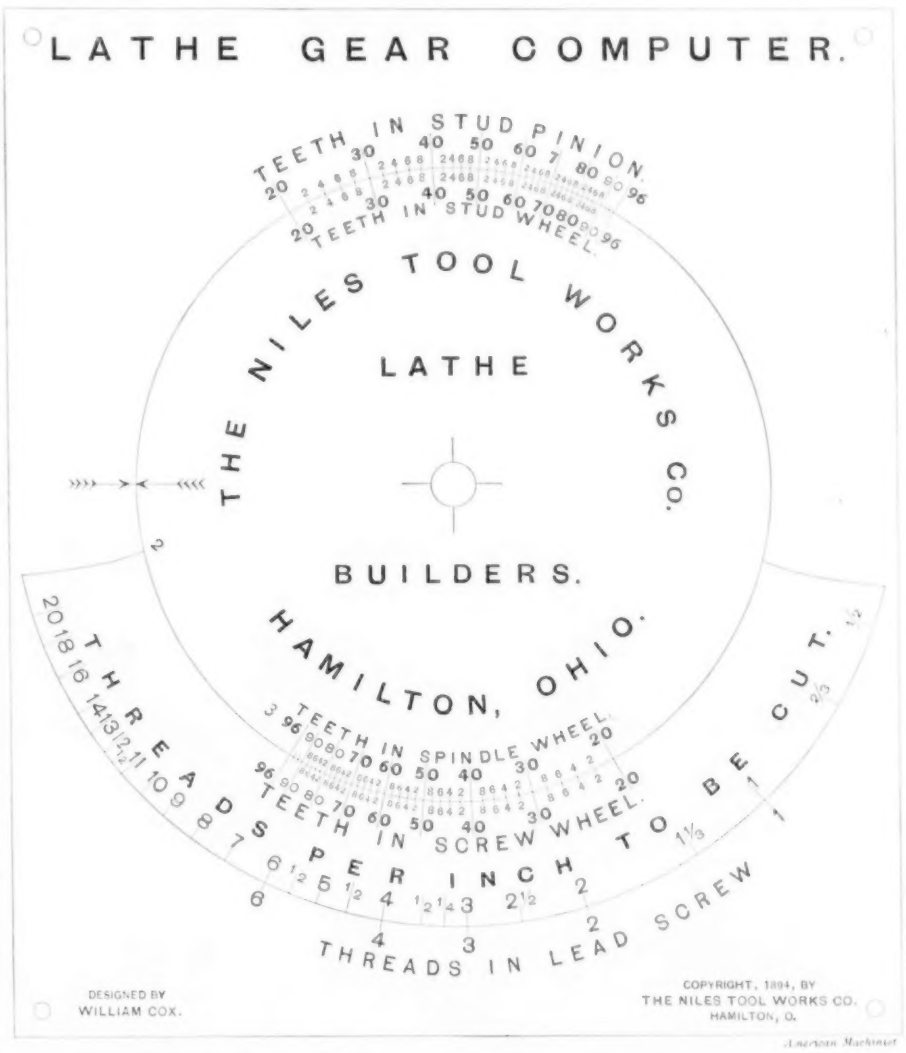
Lathe Gear Computer.

With this we give a full-size illustration of a lathe gear computer supplied by the Niles Tool Works Co., Hamilton, Ohio. It is made of sheet brass, polished and lacquered. It consists of a rectangular plate upon which a disk and a quadrant are pivoted.

For single-geared lathes the method for finding the number of teeth in gears suitable for any number of threads to be cut is as follows:

Place the arrow on the disk in line with the arrow on the rectangular plate as shown in the illustration and hold it there; then move the quadrant and set it so that the line indicating the number of threads to be cut will coincide with the line showing the number of threads per inch in lead screw; now, the numbers on any two coinciding lines on the scales marked "teeth in spindle wheel," and "teeth in screw wheel," will give the required number of teeth in gears.

For finding the number of teeth in wheels for a compound geared lathe proceed as follows: Move the quadrant round until the number of threads to be cut coincides with number of threads per inch in the lead screw; next select or choose for trial the number of teeth in gear for the lead screw and also the number of teeth in spindle gear, then move the disk so that the line indicating the number of teeth in spindle wheel will coincide with the line indicating the number of teeth in screw wheel, care being taken not to disturb the position of the quadrant; then examine the scales marked "teeth in stud pinion" and "teeth in stud wheel;" the numbers of the coinciding lines in these scales will give the required number of teeth in wheels on stud.



The operations are simpler than they appear to be from the description, and after any one is familiar with them and has acquired the habit of exact setting good results will follow. The computer was designed by the specialist in such work, Mr. Wm. Cox.

Mechanical "Information."

We take great pleasure in promoting the circulation of the following "mechanical" and original paragraph which we find in the columns of a contemporary:

The emery wheel is getting to be quite a testing machine, and if it keeps on will take the place of blow-pipe analysis entirely and form one of the main adjuncts for a chemist. With it almost any one in the shop can catch up a piece of steel and tell the instant the sparks begin to fly whether it is good steel or bad, whether it is tempered or carefully annealed. With Mushett's steel it gives no chance for a mistake, and on many kinds of castings it would be impossible to form any idea of the work were it not for the emery wheel.

It may not be generally known that there lives in Boston a mechanical engineer who is realizing a respectable income, and is now finding full occupation in correcting the adjustments of the valve mechanisms of stationary steam engines by the smell of the exhaust steam. His olfactory organs have been so developed by practice that he is able to determine at once not only the style of engine and boiler from which the exhaust proceeds, but also the minutest details of lap, lead, cut-off, exhaust opening and closure, clearance, cylinder condensation, and so forth. According to his statements, while every style of engine or each combination of engine and boiler has its own peculiar normal smell, that smell may still be recognized and traced through all the possible departures from it, and by the readjustments indicated by the abnormal scents corrected to perfection. No engine, according to his theory and practice, can work right while the exhaust smells wrong, and if the exhaust smells right the engine cannot but work at its best.

We assure our readers that the above paragraph is quite as correct and reliable as that which precedes it, and we flatter ourselves that it is not a bad sample of some of the mechanical information that is written by the yard and dealt out in suitable lengths to credulous customers.

Oiling Bicycle Bearings.

We find the following in the *Hardware Trade Journal*, London:

Several writers in the AMERICAN MACHINIST have been giving their experiences of machinery and bicycle ball bearings, and they are unanimous in protesting against the use of oil. The employment of a "lubricant," they aver, tends only to attract dust, and clogs and wears the wheels. In fact, to quote one writer on the subject, if the bearings are carefully adjusted and kept clean they do not require oil "any more than a railroad company has to oil its rails." The matter must, therefore, be taken as decided; but we expect that this finding will come as a surprise to scientific and practical men generally "on this side."

Later writers upon this subject in our columns decidedly favored the use of oil. See especially our issue of October 17th.

Bureau of Steam Engineering Report.

The annual report of the Chief of the Bureau of Steam Engineering of the U. S. Navy Department, although not voluminous, contains much that is interesting.

The total appropriation for the year was $675,000, and the expenditures seem to have been kept within that amount. The bureau during the year prepared plans and specifications for six torpedo boats, six gunboats and one tug, besides plans for new machinery on other ships and for revenue cutters. Tests have been made and are still in progress to determine the value of liquid fuel for small boats. Some remarks are offered upon the subject of water-tube boilers; the necessity for a type of boiler lighter than the Scotch or cylindrical fire-tube pattern has directed increased attention to their merits and possibilities. The assertion is made that, while the attitude of the bureau is conservative, it has been in advance of every marine establishment in America, for while private firms refused to guarantee a water-tube boiler, the bureau insisted upon their installation as a part of the power on the "Monterey."

The engine of the "Atlanta" is condemned as of absolute type and too heavy, and it is said that twin-screw engines may be substituted weighing 142 tons less and increasing the speed two knots. The same change is proposed for the "Boston."

The several navy yards are successively mentioned, with an account of the work, chiefly repairs, done at each, and some suggestions are offered looking to their improvement. The largest dry dock in the United States has just been completed at Port Royal, S. C., but there is no engine construction plant in connection with this great work, so that it is practically of little use. At Sidney, Wash., a fine dry dock is nearing completion, but there, also, there are no facilities for the repair of machinery and boilers.

A list is given of all the vessels in the U. S. Navy with the present condition of the machinery and boilers of each. The number is 83, of which 17 are wooden, and many of the engines are characterized as old or obsolete, while the condition of the boilers seems to be chronically bad. The contract trial of the steamship "Maine" is given in detail, and after that the present condition of the various vessels now under construction. These number 21, and among them are some of the most important vessels of our new navy.

The report asks for an appropriation of $1,351,195 for the year ending June, 1897. The amount for the current year is $898,990.

Foreign Appreciation of Our Navy.

The naval attaché of the Russian Embassy in Washington, Captain Mertwago, is making arrangements for the construction in this country of an electric gig for the Czar of Russia. Bids have been invited from six of the leading electric launch builders of New York, Boston and Detroit. The sum to be expended for the vessel is $4,000.

The naval attaché of the Japanese Legation, Commander Miyaoka, has made a strong report to the naval department of Japan on the merits of the United States battleship "Indiana." As this report comes at a time when Japan is looking abroad for new battleships and cruisers, it is believed that it will aid materially in securing some of the contracts for American shipbuilders.

This report has been made after the commander had spent an entire week on the "Indiana." It is made by a man who has had long experience in naval affairs, and the investigations have been made with the critical eye of an expert. In summing up his conclusions, Mr. Miyaoka makes the statements that the "Indiana" is a magnificent ship, equal to any battleship of her class afloat. The competition at the present time among the shipbuilders of the world for securing the contracts for these new ships is very keen. It is stated that while the Cabinet of Japan favor American builders, they are opposed by the naval experts who have received their training in England, and consequently believe the English shipbuilders to be the best. Nevertheless, this report, coming as it does at a time when the contracts for these ships are about to be let, will undoubtedly be of great assistance to the American builders, and it is to be hoped that the day is not far distant when our ship builders will be regularly called upon for bids on foreign naval vessels.

Notes from Atlanta.

GENERAL MACHINERY.

The exhibit in the Machinery Hall at the Cotton States and International Exposition consists mainly of engines, dynamos, pumps, water wheels, printing, typesetting, wood and fiber working, sewing, calendering, carding, soap, envelope and tobacco machinery, etc., besides the usual machinery accessaries that always form a feature of such exhibitions. A new instrument is shown called the "Brosophore" for increasing the humidity of the atmosphere in fiber mills by means of a cold water mist.

THE BOILER PLANT.

The general arrangement of the boiler plant has been given, and, as before mentioned, it consists of Stirling boilers in four batteries of two 250 H. P. boilers each.

The heating surface of the 250 H. P. size is 2,875 square feet, and grate area is 57.69 square feet. There is a stack for each battery 56 inches diameter and 129 feet high, making ratio of grate area to that of stack 3.37, nearly. Working steam pressure is 135 pounds by gage.

Two batteries are fitted with the "Meissner stoker," which gives much better satisfaction than the ordinary grate for burning fine coal, which is used here for fuel.

The ashes are carried from the pit into a hopper by an ash conveyor which runs in a straight open channel directly in front of the ash doors, and about twelve inches below the floor. It consists of a continuous chain of disks, the return being overhead.

ENGINES.

The engines are of various sizes and patterns, from 5 to 400 H. P., and are simple, compound, compound-condensing, automatic, and throttling. The most novel of these is the 100 horse-power Raymond Improved gas engine, built by the J. I. Case T. M. Co., of Racine, Wis., attached to a 1,000 light "standard" dynamo. It is vertical, having four cylinders and occupying a floor space 4x12 feet. It is started by the explosion of a charge of powder incased in a cartridge with a percussion cap; a pin communicating with the cap is struck by a hammer, thus effecting the explosion. The combined H. P. of all the engines is 2,585. A 250 H. P. Eclipse Corliss with rope drive is connected to the line shifting.

A NEW DYNAMO.

What is claimed to be novel among dynamos is the Edison Menocycle, which is a 250 K. W. single phase alternator driven by belt from a 400 H. P. Lane & Bodley Corliss. It has 16 poles and generates a current of 7,200 alternations per minute, which can be used both for incandescent lighting, arcs and power, at the same time, and off the same lines.

This feature is gained by means of an auxiliary coil, giving a displaced E. M. F., which makes it possible to start and operate Polyphase motors in the circuit of a single-phase generator and at the same time incandescent and arc lights without unbalancing the system. M. W. JOHNSON, JR.

The Baldwin Locomotive Works, of Philadelphia, has a contract from the Russian Government for forty locomotives.

COMMERCIAL REVIEW.

NEW YORK, Friday Evening, Nov. 22.

The Machinery Trade.

The market for machine tools is broadening, though by almost imperceptible degrees, the smaller lines being in greatest demand. Some machine shops are now weeding out their old tools and putting in new ones. There is a little stir in the metal goods business, which creates a demand for power presses. Prices are not advancing as sellers would like to see them. Bicycle manufacturing tools are still the leading feature of the market, but the statement is confirmed that they are becoming less active, since bicycle makers are completing their equipments for the season.

The trade in woodworking machinery is steady but quiet, a discouraging feature being the difficulty experienced in collecting money. This, like other branches of business dependent upon the building trade, will be affected indirectly by the strike of the housesmiths. In power-transmitting machinery, business is of a fair volume, but prices show no tendency to advance.

Machinists' supplies are, at present, dull; buyers will wait until the first of the year before replacing their stocks, which are running low. Leather belting is steady as regards both prices and demand, the latter being rather quiet.

Engines, Boilers and Pumps.

The phases of the engine trade change but little from week to week, incidents of business being as frequently erratic phenomena as indications of its real tendency. But a view of the situation broad enough in point of time to determine its true relations, shows that there is improvement in the selling of high-speed engines of moderate size, such as are designed for incandescent electric lighting of office buildings and factories. Engines for arc lighting are not in great requisition. Large engines, both high speed and otherwise, are dull, and notwithstanding that certain types, at least, of Corliss engines are claimed to have a good and steady market. The fact that some of them have sold as low as three cents a pound may indicate what the trade has already passed through.

Competition in boilers is stated by one party to be, for this market, sharper than that in engines. As to this there may be a variety of opinion; but for the cheaper grades of boilers, at least, prospects are not becoming much brighter. The export trade with Cuba is paralyzed by the war, which is true, indeed, of other Spanish-American

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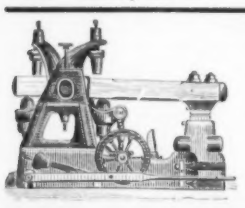

BRADLEY HAMMERS.

If you plate, draw, square, taper, swage, collar, spindle, or do any manner of die forging in iron or steel, a Bradley Hammer will soon pay for itself by what it will save over any other similar tool. Helve, Upright and Strap Styles. Send for circulars.

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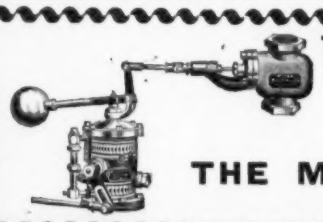

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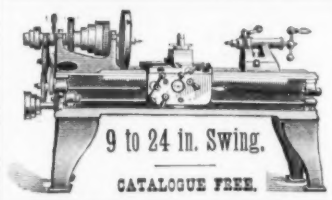

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countries that are in a state of chronic revolution. Prices of boiler materials, which, to a great extent, govern those of boilers themselves, have fallen off a little from the point they attained not long ago. For the best class of boilers the demand is said to be excellent.

The market for steam appliances is spasmodic and unstable, the present week being reported a good one. Prices of inferior grades are lower than they should be, but those of the higher are comparatively well held. There is an active demand for valves and other fittings. A brisk trade is also going on in gages and similar specialties, among which recording gages are steadily gaining popular favor.

Pumps, as well as boilers, are the subject of strong competition. One manufacturer reports having experienced a slight decrease in demand during the past few weeks. There is, however, a fair call for pumps of first-class makes. Among other lines a reasonable activity is shown in air pumps. Refrigerating machinery, which might be referred to in this connection, is now in good demand in anticipation of the spring.

Iron and Other Metals.

For pig-iron there is little or no improvement and much weakness exists and the buying side of the market is still holding out before placing orders. But foundries are consuming a great deal of iron, and their melts are being increased. The opinion is given that at the present time the consumption exceeds the output. Middlemen and jobbers are realizing on Bessemer, which they bought up before the advance, but this does not argue a curtailment of consumption. Prices are but little different from the end of last week, though the quotations exhibit rather less firmness in No. 1 X Foundry Northern.

The Western market for steel billets is weaker and unsettled, and, of course, the Eastern is sympathetic in tone. Prices are a shade lower. A fair demand exists for tool and machinery steel at unchanged quotations. In cold rolled steel shafting, on which we this week quote prices, there is a notably increased business. A combination of manufacturers which has been in force for six or eight weeks is beginning to have its effect, and buyers are reluctantly taking stock on the rising market.

Copper shows some weakness. Consumers do not buy heavily, and the purchasing by others is generally limited to small lots for early delivery.

Tin is in very fair selling, November and December being months usually favorable to this trade. The price, notwithstanding, has weakened. Shipments from the East Indies have increased, and a larger supply has broken the market.

Lead is quiet, this season of the year not being its best. Refiners have been pulling out of the market and asking more for their lead. The advance in the price is principally in sympathy with the foreign quotations.

Spelter is extremely dull. The price is low as compared with that of the ore, which usually governs it. When spelter, some time since, was selling at 4c. in St. Louis, ore was but little higher than at present.

Antimony is steady and featureless, with but little business transacted.

QUOTATIONS.

SATURDAY EVENING.

Iron—American pig:		
No. 1 X foundry, Northern	$13 50	a14 50
No. 2 X foundry, Northern		a13 50
No. 2 plain, Northern		a13 00
Gray forge, Northern		a12 00
No. 1 foundry, Southern	13 75	a14 00
No. 2 foundry, Southern	13 50	a13 75
No. 1 soft, Southern	13 75	a14 00
No. 2 soft, Southern	13 50	a13 75
No. 3 Southern	13 25	
Gray forge, Southern	12 00	a12 50

Bar Iron—Common, on dock, 1.35 a 1.40c.; refined, on dock, 1.50 a 1.60c.

Tool Steel—Ordinary sizes, standard quality, 6 a 7c.; extra grades, 11 a 12c.; special grades, 16c. and upwards.

Machinery Steel—2 a 2½c.

Cold Rolled Steel Shafting—Base, 2½c. in car loads; 2¾c. in smaller quantities; 3c. from store.

Copper—Lake Superior ingot, 11c.; electrolytic, 10¾ a 10⅞c.; casting copper, 10¼ a 10⅜c., according to brand.

Tin—Spot price, 14.30c. net.

Lead—Common Western, 3.22½ a 3.25c., in car load lots.

Spelter—Ordinary Western brands, 3.50c., or probably a shade less, New York delivery.

Antimony—Cookson's, 7¾ a 7⅞c.; Hallett's, 6¾ a 7c.; Japanese, 6¾ a 6⅞c.

Lard Oil—Prime city, 52 a 52½c.

NEW CATALOGS.

There are three sizes of Standard Catalogs, 9″ × 12″, 6″ × 9″ and 4⅝″ × 6″. We recommend the 6″ × 9″ size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The Mossberg Mfg. Co., Attleboro, Mass., issue a catalog of special machinery and jewelers' tools, which will be found of special interest to those engaged in jewelers' and similar operations, and is 6″x8¾″.

The Babcock Printing Press Mfg. Co., of New London, Conn., have issued a new catalog of presses, containing a large number of letters from users, certifying to the excellence of the machines. As a sample of the work that can be done upon the presses, the catalog itself is evidence of excellence. It is 6¾″x10¾″.

Beaman & Smith, of Providence, R. I., have issued what they call "Catalog D," which contains their productions in the line of milling machines of various designs, horizontal boring machines, engine lathes, safety tapping chucks, etc. The catalog also contains some tables and data of use to shop men, and is 3¾″x5¾″.

Harry C. Spring, 802 North Second Street, St. Louis, Mo., sends us a vest-pocket edition of his illustrated catalog, the pages of which are evidently made by a photographic reproduction of the larger sized catalog. It is a very complete illustrated book of mill, factory, plumbers', steam, gas fitters', and engineers' supplies, and it can be carried in the vest pocket.

MANUFACTURES.

The management of the Southern Railway has decided to build repair shops at Alexandria, Va., to cost $250,000.

A company will be formed by D. E. Mathews and others, of Huntington, W. Va., to manufacture a combination safety lock.

The Portland Steamship Company has been organized, with a capital of $1,000,000, to engage in a general freight business.

There was incorporated recently the Schofield Gear and Pulley Co., at Hartford, Conn., by J. B. Shannon and Wm. B. Collins.

The National Rubber Co., Bristol, R. I., which shut down a short time ago, re-opened on November 18th, giving work to 1,300 operatives.

Work has been commenced on a new type of passenger engine at the Altoona shops of the Pennsylvania R. R. It will be known as class L.

There has been incorporated at Oshkosh, Wis., the E. B. Hayes Machine Co., by E. B. Hayes, F. J. Hayes, of Oshkosh, and V. R. Hayes, of Milwaukee.

The new factory of J. E. Porter Co., Ottawa, Ill., is now completed, and they expect to be operating it by December 1st. The plant they have lately occupied at Turner, Ill., near Chicago, will be sold.

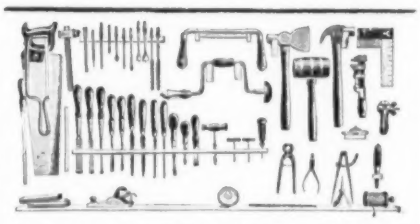
F. E. & J. M. Church, Angelica, N. Y., are putting in new machinery to manufacture their "Hercules" barrel cover, the sale of which is meeting with such success that their factory is taxed to its full capacity to fill orders.

The C., N. Y. & W. R. R. shops at Angelica, N. Y., are putting in a large amount of new machinery, and have more than doubled their working force. Business is lively, and it looks as if they will have all the work they can possibly handle for a long time.

The Racine Boat Mfg. Co., Racine, Wis., has just closed a contract for building a large steam pleasure yacht to be fitted with quadruple expansion tubular boilers and electric light plant. New tools and considerable material will be required for this work.

A franchise has been granted by the commissioners of Noble County, Ind., to build and operate the Huntington, Columbia City & Ligonier Electric Railway. Among those lending support to the undertaking is Mr. McNagny, ex-Congressman.

At the Philadelphia & Reading shops at Palo Alto, the machinists, blacksmiths and boiler-



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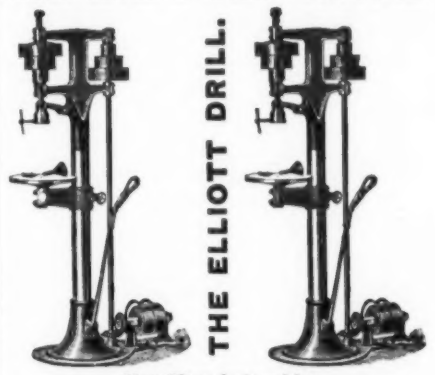

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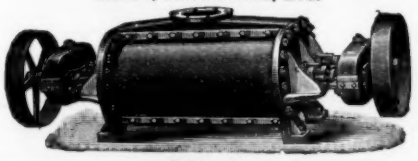

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RECEIVER'S SALE.

Alfred S. Orchard, Temporary Receiver of the CHRISTIE MANUFACTURING COMPANY, hereby invites sealed bids for the plant of the Company, to be in his hands on or before the 30th day of November, 1895, to be opened in the presence of bidders on the 2nd day of December, 1895, at 12 o'clock noon. The property will be sold to the highest bidder, if approved by the Temporary Receiver and by the Court.

The plant originally cost upwards of $20,000. It consists of one 48 in. by 48 in. Pond Planer; one 50 in. by 70 in. Fifield Lathe; one 7 H. P. Otto Gas Engine and a large amount of other machinery, with shafting, belts, pulleys and tools, and the usual equipments of a first-class machine shop, all in good condition. Premises are open to inspection. Address bids to

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SEND FOR SPECIAL PAMPHLET.
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NEW YORK, 86 and 88 Liberty St. BOSTON, 70 Kilby St. PHILADELPHIA, 724 Arch St. CLEVELAND, 24 South Water St. CHICAGO, 185 to 189 Van Buren St. ST. LOUIS, Eighth and St. Charles Sts. INDIANAPOLIS, 64 South Pennsylvania St. DETROIT, 155 Jefferson Ave.

makers, who have been working ten hours per day (except Saturday, when work is stopped at noon), commenced on the 18th inst. to work only nine hours per day. This reduction also touches the car shops, and affects about 225 men.

The Pratt & Whitney Co., of Hartford, Conn., are enlarging their factory by the erection of a new blacksmith's shop, which will be 175 feet by 60 feet, with basement. The basement will be used for storage of stock, dies, etc., and an elevator will be used running from the basement floor to the main shop floor. The foundations of the heavy machinery will be extended up to the main floor. This new shop will permit them to add the space occupied by the present blacksmith's shop to their main building, and it will be raised to four stories; when completed it will make their main building 570 feet long and 42 feet wide, 140 feet of which will be three stories high, and the rest four stories. They are also adding to the front of this main building a short addition, which will give them additional office room on the ground floor, additional room in the drafting room on the second floor, and additional shop room on the third floor. Somewhat over 1,100 men are now employed, which is a greater number than has ever been employed by this company previously.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The Cash and Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

TO SUBSCRIBERS

whose names appear on our **subscription** list, this paper will give two free insertions under this heading to those in want of positions. The advertisement to occupy a space of not more than five lines. Additional space or insertions must be paid for in advance at regular rates.

Draftsman, with technical education, shop and office experience, wants pos'n. "Tech.," AM. MACH.

Wanted—Position as mechanical traveling salesman, 10 years' experience. Box 164, AM. MACH.

First-class patternmaker desires pos.; young man, good refs., 7 years' exp. Box 166, AM. MACH.

Wanted—Position by draftsman, technical graduate with shop experience. S. C., AM. MACHINIST.

Wanted—First-class tool makers; only A1 men need apply. Reply with references, and state salary exp'd. Lindsay Bicycle & Mfg. Co., Lafayette, Ind.

Wanted—A first-class expert in gilding, plating, etc.; experienced in electrotyping in relief; best references. Address T. J., 100, AMERICAN MACHINIST.

Wanted—Draftsman, one who has had experience on machine tools; permanent position to right man. Address Tools, AMERICAN MACHINIST.

Wanted—Fifty first-class tool makers, screw machine hands and die sinkers, familiar with gun and bicycle work. Remington Arms Co., Ilion, N. Y.

Tech. graduate with shop experience wishes a position as draftsman and designer or assistant to superintendent. Special knowledge of gearing and gas engines. S. S., AMERICAN MACHINIST.

(*Continued on Page* 955.)

CLEVELAND TWIST DRILL CO'.S GRIP SOCKETS.

No More Twisted Tangs.

Larger drills can be used with smaller shanks than ever before.

No charge for the groove in the shanks.

Send for Descriptive Price List.

Cor. Lake and Kirtland Sts., Cleveland, Ohio.

SECOND-HAND MACHINERY.

1 86 in. x 18 ft. Lincoln Triple-Geared Engine Lathe.
1 84 in. x 21 ft. Wilmarth " " " "
37 in. x 42 in. x 10 ft. Fifield Lathe, C. Rest and P. C. Feed.
34 in. x 47 in. x 16 ft. Pond Mach. Tool Co. Lathe, C. Rest and P. C. Feed. Has 24 in. Chuck.
32 in. x 8 ft. D. W. Pond Lathe, C. Rest and P. C. Feed.
29 in. x 10 ft. Perkins Lathe, P. Gib Rest and P. C. Feed. Has 17 in. Chuck.
26 in. x 17 ft. D. W. Pond Lathe, C. Rest and P. C. Feed.
26 in. x 22 ft. " " " " " " " Has 21 in. Chuck.
24 in. x 10 ft. Pratt & Whitney Lathe, C. Rest and P. C. Feed.
20 in. x 8 ft. Fifield Lathe, C. Rest and P. C. Feed.
20 in. x 11 ft. Wm. Sellers Lathe, C. Rest and P. C. Feed. Has 16 in. Chuck.
20 in. x 8 ft. Pratt & Whitney Lathe, C. Rest and P. C. Feed.
18 in. x 9 ft. " " " " " " "
16 in. x 10 ft. Bullard Lathe, Plain Gib Rest.
14 in. x 6 ft. S. Ashton Hand Lathe, Plain Gib Rest.
Lot Speed Lathes Assorted.
60 in. x 60 in. x 26 ft. L. W. Pond Planer.
38 in. x 38 in. x 10 ft. " " " "
36 in. x 36 in. x 10 ft. D. W. Pond "
32 in. x 32 in. x 10 ft. " " " 2 Heads.
26 in. x 26 in. x 6 ft. Pond Mach. Tool Co. Planer.
15 in. x 15 in. x 16 in Whitcomb Crank Planer.
12 in. Stroke, Warren Traveling Head Crank Shaper.
15 in. " Hendey Friction Shaper.
Semi-Universal Warren Radial Drill, 48 in. Arm.
Full " Bickford " " 72 in. "
32 in. D. W. Pond Upright Drill, 8 Gears and Power Feed.
30 in. Prentice " " " " "
28 in. Barney " " " " "
No. 3 Brown & Sharpe Universal Milling Machine.
60 in. Pond Boring and Turning Mill, 2 Heads.
72 in. Newark Mach. Tool Co. Pulley Lathe, 2 Tools.
26 in. Stevens Pulley Lathe, 1 Tool.

700 Machine Tools in Stock. Send for Lists. Bicycle Catalog Just Out.

PRENTISS TOOL AND SUPPLY CO.
115 LIBERTY STREET, N. Y.
Chicago Store: 62 & 64 So. Canal St.

WANTED—500 MACHINISTS AND DRAFTSMEN

To know that they can get complete sets of prints of Corliss and Automatic Engines, in both Simple, Tandem and Compound types, photo-reduced from practical working drawings, to pages 7 in. x 11 in. Dimensions easily read. Send TO-DAY for samples and very low prices. Opportunity of a lifetime. C. M. GIDDINGS, M. E., Rockford, Ill.

WATER WHEELS

FOR HEADS 3 FEET TO 2000 FEET.

STATE YOUR HEAD and SEND FOR PAMPHLET.

JAMES LEFFEL & CO., Springfield, O., U.S.A.

Second-Hand Machinery.

LATHES.

2 16 in. x 5 ft. Foot & Power.
2 11 in. x 5 ft. Power only.
1 15 in. x 6 ft. Dustin.
1 16 in. x 8 ft. Flather.
2 18 in. x 8 ft. Flather & Prentice.
3 18 in. x 8 ft. Lodge & Davis.
2 21 in. x 10 ft. Pratt & Whitney.
1 27 in. x 10 ft. Dustin.
1 28 in. x 12 ft. Blaisdell.
2 30 in. x 14 ft. Lincoln.
1 32 in. x 13 ft. Bement Triple Geared.
1 22 in. x 10 ft. Niles.
1 24 in. x 10 ft. Niles.
1 79 in. Driving Wheel, Bement.
1 48 in. x 18 ft. Gay & Silver.

PLANERS.

3 48 in. x 32 in. x 6 ft. Pond, two heads.
1 48 in. x 32 in. x 8 ft. Pond, two heads.
3 24 in. x 24 in. x 6 ft. W & L., one head.
1 28 in. x 28 in. x 8 ft. Gay & Silver.
1 32 in. x 32 in. x 10 ft. W. & L.
1 38 in. x 38 in. x 10 ft. Aldrich.
1 32 in. x 10 ft. Open Side.
1 60 in. x 60 in. x 22 ft. Hepworth.

DRILLS.

3 22 in. Back Geared.
2 25 in. " & P. F., Snyder.
1 34 in " " Harris.
2 No. 1½ Niles Radial.
2 Suspension Drills.

MILLING MACHINES.

1 No. 1 B. & Sharpe.
2 No. 13 Garvin.
1 No. 15 "
1 No. 2 " Hand, and others.

SHAPERS.

9 in., 12 in., 13 in., 15 in., 20 in.

MISCELLANEOUS.

1 18 in. P. & W. Screw Machine.
1 20 in x 6 ft. Flather "
2 Horiz. B. & D. Machines.
1 Cylinder Borer, P. & A.
1 30 in. Motor Gear Lathe
1 Double Punch and Shear.
1 30 in. Pulley Lathe.
1 Hydraulic Riveter.
2 Bolt Cutters.
1 Nut Tapper.
1 20 in. Pattern Lathe.

Also large stock of other tools. Send for List.

Eastern Branch Niles Tool Works Co.,
136 and 138 Liberty St., NEW YORK CITY.

E. W. BLISS CO.

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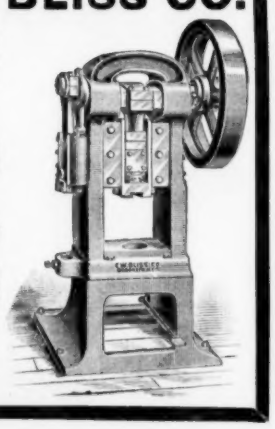
96 W. Wash'n St., CHICAGO.

Presses, Dies, and Special Machinery

For BICYCLE, Electrical, and All Sheet Metal Work.

OWNERS OF Stiles & Parker Press Co.



SECOND-HAND MACHINE TOOLS.

ENGINE LATHES.

25 x 12, Fifield, Compound Rest.
15 x 6 Blaisdell, Compound Rest with turret.
13 x 6 Ames, Rise and Fall Rest.
11 x 4 Mann Lathe.
16 x 7 Maker Unknown.
16 x 8 Blaisdell, Plain Rest.
18 x 10 Flather, Plain Rest.
18 x 10 Blaisdell, Plain Rest.
28 x 20 Perkins, Compound Rest.
37 x 14 Maker Unknown.

PLANERS.

16 in. x 16 in. x 4 ft. Hendey.
20 in. x 20 in. x 4 ft. Nashua.

SHAPERS.

10 in. Juengst, Crank.
12 in. Juengst, Crank.
10 in. Woodand Light, Traverse Head.
18 in. Putnam, Traverse Head.
15 in. Juengst Friction Shaper.

DRILL PRESSES.

10 in. No. 1 Slate's Sensitive.
6 Spindle Quint. Turret.
No. 2 Three-Spindle, Garvin.

DRILL PRESSES.

No. 2 Four-Spindle, Pratt & W.
No. 4 Four-Spindle, Garvin.
21 in. Kirkhoff, W. & L. B. G.
24 in. Blaisdell, Wheel Feed.
24 in. Aurora, Back Geared.
30 in. Pond, Back Geared, Power Feed.
9 ft. Holly Mfg. Co., Radial.

SCREW MACHINES.

No. 1 Garvin, Wire Feed.
No. 5 Brown & Sharpe.
No. 1 Garvin, Plain.
No. 2 Brown & Sharpe, Plain.
No. 2 Garvin, Wire Feed.
16 in. x 5 ft. Reed Turret Chucking Latne.

MILLING MACHINES.

No. 2 Pratt & Whitney, Lincoln.
No. 2 Garvin, Plain.
No. 0 Garvin Universal.
No. 2 Garvin Duplex.
No. 2 Garvin Hand.
No. 4 Brainard Standard Universal.
Putnam-Lincoln.
No. 2 Pratt & Whitney, Lincoln.

Also, a large list of other machines. Write for complete list, detailed description and prices.

THE GARVIN MACHINE CO.,
LAIGHT & CANAL STS., NEW YORK.
Also, 51 North 7th St., Philadelphia, Pa.

SECOND-HAND MACHINERY.

80" Gould & Eberhardt Gear Cutter.
26" Pratt & Whitney Chucking Lathe.
60" Triple-geared New Haven Lathe, with chuck jaws.
40" New Haven Back-geared and Power-feed Drill.
32" Double-head Pond Planer.
No. 1 Giant Key Seater.
Send for complete list. Send for catalogue of Bicycle machinery.

PRENTISS TOOL AND SUPPLY CO.,
62 & 64 S. CANAL ST., CHICAGO, ILL.

MACHINERY FOR SALE.

28 in. x 24 in. x 7 ft. New Haven Planer. New.
21 in. Gould & Eberhardt Drill. Good as new.
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1-4 to 1 1-4 in. Open-die Bolt Cutter. Good as new.
Nos. 1, 3 and 6 Roots Pressure Blowers. A1 condition.
9 x 9 Greenfield Upright Engine. Good as new.
18 x 5 x 10 Brass Lined Duplex Pump.
1 12 x 18 Slide Valve Engine.
Lot 6 1-2 in. and 7 1-2 in. Hammered Steel Shafting, Bearings, Friction Clutch Pulleys, etc., less than half value.
COOKE & CO.,
163 and 165 Washington Street, New York.

SECOND-HAND TOOLS.

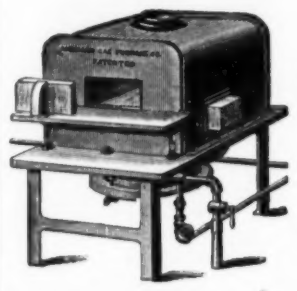
MODERN STYLE. FIRST-CLASS ORDER.
Will Be Sold Very Low Before Removal.

ENG'NE LATHE—Blaisdell, 13 in. x 6 ft.
" " Blaisdell, 16 x 6 ft., Raise and Fall Rest.
" " Pratt & Whitney, 16 x 7 ft., Raise and Fall Rest.
" " Putnam, 16 x 8 ft., Raise and Fall Rest.
" " Flather, 18 x 8 ft., Hollow Spindle, Cross Feed.
" " Pond, 20 in. x 15 ft., Extra Heavy, A 1.
" " Harrington, 20x10 ft., Compound Rest, Cross Feed
" " Fay & Scott, 36x18 ft., Compound Rest, Cross Feed.
" " Pratt & Whitney, 42 in., raising blocks to 48 in. Triple Geared, Compound Rest and Cross Feed, A 1 order.
" " Hewes & Phillips, 60 in. x 20 ft., Triple Geared, Compound Rest, etc. A 1.
" " Union, 72 x 20 ft., Triple Geared, Screw Feed.
PLANER—Pease, 22 x 5 ft., Heavy Pattern, Improved Style, A 1.
" Hendey, 22 x 5 ft., Improved Style, A 1.
" Gould & Eberhardt, 26 in. x 8 ft. A 1.
" Pond, 32 in. x 8 ft. Good order.
" Pond, 36 x 12 ft. A 1 order.
" Betts 36 x 10 ft., Extra Heavy.
" Gray, 48 x 12 ft., Spiral Geared, Improved A 1.
" Betts, 60 x 16 ft., 4 Heads, Extra Heavy, A 1.
" Crank 12 in. stroke "Pond's."
SHAPER—Hewes & Phillips 10 in. Crank Motion.
" Gould & Eberhardt 15 in. Crank Motion.
" Prentice 17 in. Crank. Good as new.
" Hendey 24 in. Friction. Good order
" Pratt & Whitney 14 in. x 60 in., Traveling Head, 2 Tables.
" Fitchburg 14 in. Traveling Head, 28 in. Feed
" Warren 14 in. stroke, Traveling Head. A 1 order.
DRILL—Prentice 26 in., Friction Pulleys for tapping.
" Blaisdell 28 in., Back Gears.
" Hamilton 28 in., Back Gears, Automatic Feed.
" Pond 32 in. Extra Heavy, Back Gears, Automatic Feed.
MILLING MACHINE—Pratt & Whitney No. 2 Hand Fed and Vise.
" " Garvin No. 3, Power Feed, Vise, etc.
" " Kempsmith Universal Miller. Good as new.
" " Lincoln Pattern with Vise.
SCREW MACHINE—Niles, 2 in. hole, Carriage Feed with Tools.
GEAR CUTTER—Gould & Eberhardt, 25 in. Automatic.
" " Gould & Eberhardt, 30 in. Automatic.
" " Hewes & Phillips, 60 in. Semi-Automatic.
PRESSES—Bliss No. 18 and 19.
" Stiles No. 1, 2 and 3.
Horizontal Boring and Drilling Machine, Sellers 60 in.
Upright Boring and Turning Mill, 38 in. 2 Heads, A 1.
Steam Hammer 300 lb., Ferris & Miles.
Boiler Punch, 24 in. Gap, Standard Size.
Boiler Rolls, 10 ft., Improved Style, A 1.
" " 8 ft., Extra Heavy.
" " 7 ft., Hilles & Jones, A 1.
" " 6 ft., Extra Heavy.

BICYCLE MACHINERY
CONSISTING OF SCREW MACHINES, MILLING MACHINES, DRILLS, LATHES, PRESSES, SHAPERS, Etc.

J. J. McCABE,
SUCCESSOR TO E. P. BULLARD'S N.Y. Mach'y Warerooms.
14 Dey St., NEW YORK.

AMERICAN GAS FURNACE CO.,



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For the economical generation and systematic application of HEAT.

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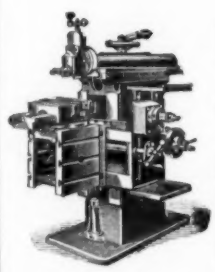

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Planers,

Milling Machines,

Drills,

Turret Machines and Machine Tools.

A LARGE STOCK always on hand at low prices at

HILL, CLARKE & CO.,
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BEFORE REMOVAL

At Phœnix Iron Works, Trenton, N. J.

15 in. x 6 ft. Engine Lathe.
22 " 12 " " "
29 " 13½ " " "
26 " 20 " " "
37 " 30 " " "
71 " 18 " " "
52 in. x 20 ft. Engine Lathe.
19-36 and 50 in. Drills.
Portable Drill.
36 in. x 14 ft. Planer.
12 in. Shaper Traverse Head.
Gear Cutter, 54 in.
Milling Machine.

10 ft.-16 ft. Vertical Boring and Turning Mill, Cranes, Blower, Boiler Rolls, Punch and Shear, etc.

Send for full list and prices.

GEORGE PLACE MACHINE CO.
145 Broadway and 86 Liberty St., NEW YORK.

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GARDNER

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IT IS THE BEST. FULL THREADS AT ONE CUT. ALL PARTS SUBJECT TO WEAR CAST HARDENED. ALL GUIDES OF HARDENED STEEL. ADJUSTABLE DIES. EXACT SIZE IRON 1/32 OVER SIZE IRON CUT WITH SAME DIE

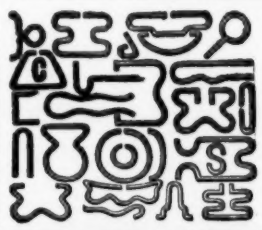
Charles H. Besly & Co.
FINE TOOLS
SUPPLIES FOR MFRS. METAL WORKERS ETC
Chicago, Ill. U.S.A.

MACHINE TOOLS.

IN FIRST-CLASS CONDITION.

16 in. F. B. Miles Slotting Machine.
2,400 Pound Miles Steam Hammer, Single Standard.
30 in. by 27 ft. Pratt & Whitney Engine Lathe.
Horizontal or Floor Boring Machine, Pratt & Whitney.
Two (2) 5 ft. Universal Radial Drills.
21 in. x 11 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
19 in. x 8 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
26 in. x 8 ft. Pond Machine Tool Co. Engine Lathe.
19 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
22 in. x 12 ft. Pratt & Whitney Engine Lathe, Hollow Spindle.
40 in. Bement Vertical Drilling Machine.
24 in. Pratt & Whitney Vertical Drilling Machine.

GEORGE PLACE MACHINE CO.,
145 Broadway & 86 Liberty St., New York.



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PIN, SAFETY PIN, HOOK AND EYE MACHINERY,

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Bent Wire Goods a Specialty. Send Samples that we may quote prices for either machine or the Goods.

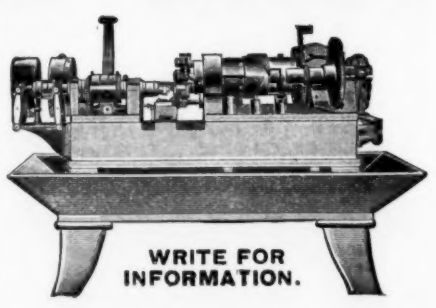
STEEL BALLS

For all Anti-Friction Purposes.

WE ALSO MANUFACTURE

AUTOMATIC SCREW MACHINES
AND
SCREW MACHINE PRODUCT
OF EVERY DESCRIPTION.

Cleveland Machine Screw Co.,
CLEVELAND, OHIO.



WRITE FOR INFORMATION.

Wanted—A first-class draftsman by one of the largest shops; prefer a man who has had experience on Corliss engine work and heavy machinery. Address Box 162, AMERICAN MACHINIST.

Wanted—Three or four apprentices on jewelers' machinery; must not be under 17 years of age, and have a fair education. Henry Blundell & Co., 35 to 39 Clifford Street, Providence, R. I.

Wanted—2 or 3 1st-class general machinists on light tool making, small aut. machinery, jigs, fixtures, etc.; state age, experience, and wages expected. Address Mass, AMERICAN MACHINIST.

Wanted—By a machinist, position as foreman or tool maker in bicycle factory; 4 years' experience with screw and hub machinery in the manufacture of bicycle wheels. C. A. L., AMERICAN MACHINIST.

Supt. desires change, thor'ly convers't with latest methods of producing work economically; have made specialty of forge and mach. work, good executive ability, best refs. Latest Methods, AM. MACH.

Position wanted, machine shop general foreman, 12 years' experience as such; sober, reliable, of good executive power, well up in Corliss and ice machinery. Address Push, AMERICAN MACHINIST.

Wanted—Foreman for tool room in gun factory; a good opening for the right man. State age, experience, wages required, and give references. Box 163, AMERICAN MACHINIST.

Wanted—One good draftsman for a shop manufacturing hoisting and haulage engines; one who has a knowledge of machinery used in and around coal mines preferred; state age, experience and wages expected. Address Penna, AM. MACHINIST.

Wanted—First-class mechanic to take charge of the construction of steam and gas engines. State age, experience and references. Address Superintendent, Box 715, Cincinnati, Ohio.

Wanted—A foreman patternmaker desires to make a change, capable of handling any number of men, with large experience on high-speed engine and dynamo work. Can furnish best of reference as to ability and character. H., AM. MACH.

Wanted—Immediately, a first-class designer and draftsman for marine engines, boilers and propeller wheels, one with shop experience preferred. Address with full particulars, The Jenks Ship Building Co., Port Huron, Mich.

Wanted—As asst. supt., a technically educated young man, exp'd in duplicating parts of engines by rapid process work, handling men, reducing cost, and increasing output; room for the right man to grow; 1st-class refs. must be inclosed with applications. Address Box 165, AM. MACHINIST.

Wanted—Foundry foreman; one who can work 100 men if necessary, on general machinery castings. One who understands melting and mixing, and can produce *best quality* work at a reasonable cost. No experimenter need apply. Permanent position and good wages. Coke, AM. MACHINIST.

Wanted—An intelligent man in every machine shop in New England to utilize his spare time in raising clubs of subscribers for the AMERICAN MACHINIST; liberal commission. Address, with references, John A. Walker, N. E. Agent, No. 4 Church Street, Dorchester, Mass.

✣ MISCELLANEOUS WANTS ✣

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 3d hd lathes & planers. S.M.York,Clev'd,O.

Calipers & Gauges. F. A. Welles, Milwaukee, Wis.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

For Sale—A first-class key seater, new. Address Mitts & Merrill, 913 Tilden St., Saginaw, Mich.

Best and cheapest Bolt Header made by C. H. Baush & Sons, Holyoke, Mass.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz, Schumacher & Co., Cincinnati, O.

Drawings, mech., executed at home, at reasonable prices. Draftsman, 277 Clinton St., B'klyn.

Wanted—To secure interest and management of medium size, modern mach. works, by young man, good mech. and business ability; can secure plenty of work. Give full partics. Mech. Eng'r., AM. MACH.

For Sale—Tabor duplex automatic molding machine with 18-inch cylinder; molds two flasks 12x15, or one flask 15x24 inches; perfect condition. Box 94, AMERICAN MACHINIST.

Wanted—Forging, pattern casting and general machine work to do. F. F. Chase Machine Works, Plainfield, N. J.

Wanted—An Idea. Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write John Wedderburn & Co., Patent Attorneys, Washington, D. C., for their $1,800 prize offer.

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Mem. A. S. M. E., Consulting M. E.,
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F. B. COREY, Electrical Expert.
Elec. Apparatus Designed,
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CHARLES A. HAGUE,
CONSULTING ENGINEER.
Pumping Plants, Power Plants, Steam, Water, Electricity, Designing and Experting.
P. O. Box 323, N. Y.

HENRY F. NOYES,
Solicitor of Patents and Mechanical Expert,
523 Monadnock Block, CHICAGO, Ill.

FRANK H. POND,
Consulting Engineer,
619 Wainwright Building, ST. LOUIS, Mo.

C. L. REDFIELD,
Designer of Special Machinery.
Expert in Patent Causes.
Room 604, 269 Dearborn St., CHICAGO, Ill.

C. E. SARGENT, M. E.,
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WM. O. WEBBER,
Consulting Engineer. Shop Methods and Economic Production a Specialty.
No. 78 Mason Building, (Tel. 2102) BOSTON, Mass.

Style A, Three-Jaw.

Ask your nearest Dealer, or send to the Manufacturers for

THE LATEST IMPROVED DRILL CHUCKS,

Strong, Accurate, Durable, Cheap,

THE E. HORTON & SON CO.,
Windsor Locks, Conn., U. S. A.

Style B, Two-Jaw.

Or CHAS. CHURCHILL & CO., Ltd., 21 Cross St., Finsbury, London, Eng. **Awards at the World's Fair.**

"CUSHMAN" CHUCKS.

For Lathes, Drills, Chucking and Screw Machines, and for Special work.

SEND FOR CATALOGUE.

THE CUSHMAN CHUCK CO., HARTFORD, CONN.

THOS. H. DALLETT & CO.,

YORK ST. & SEDGLEY AVE., PHILADELPHIA.

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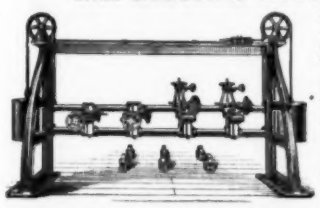

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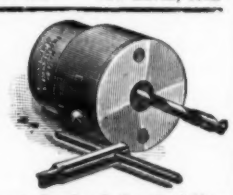

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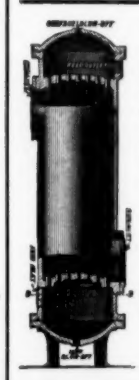

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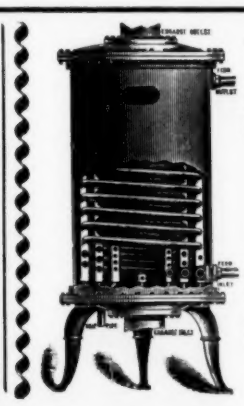

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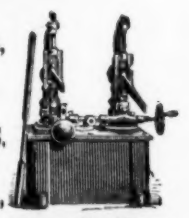

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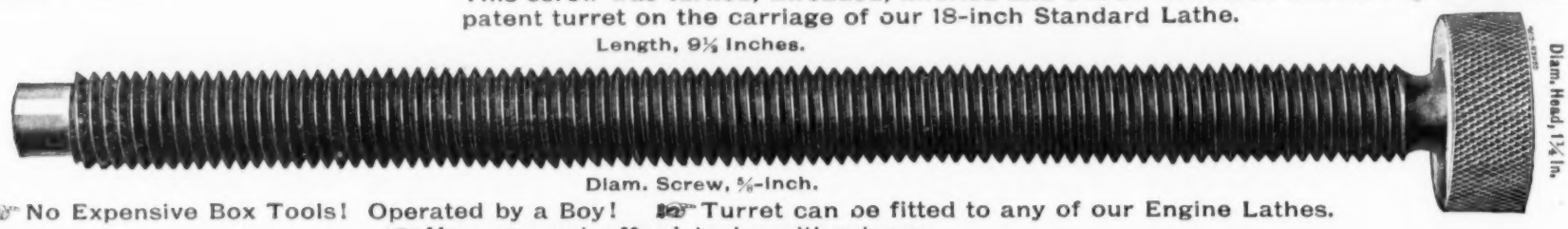

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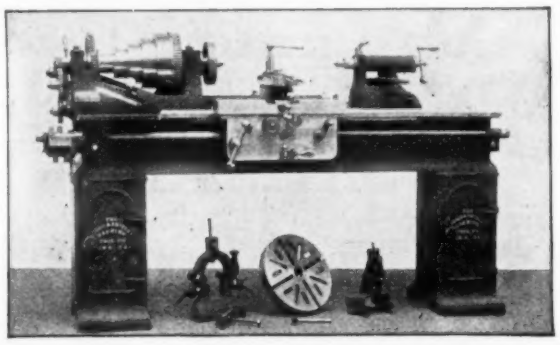

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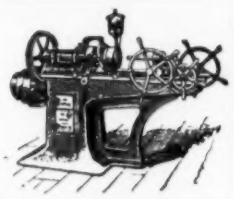

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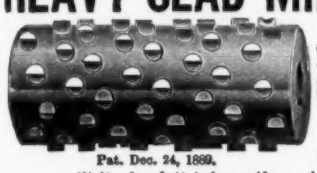

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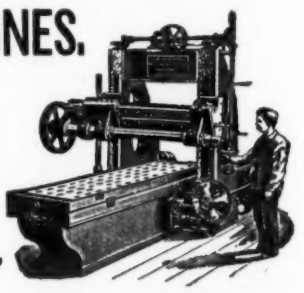

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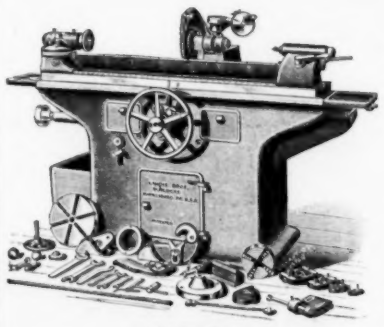

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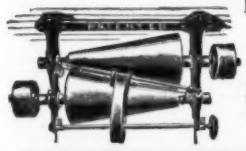

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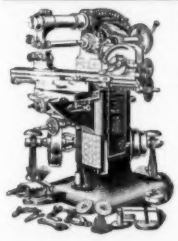

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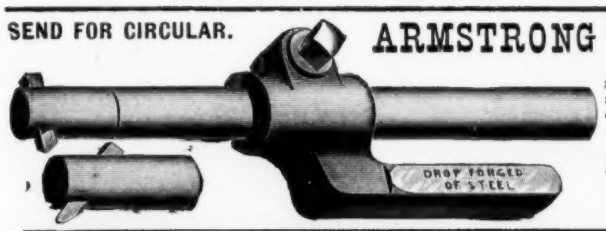

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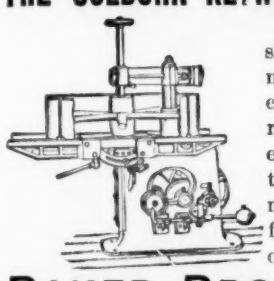

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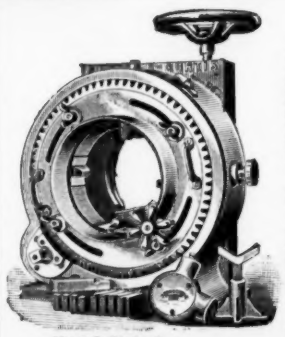

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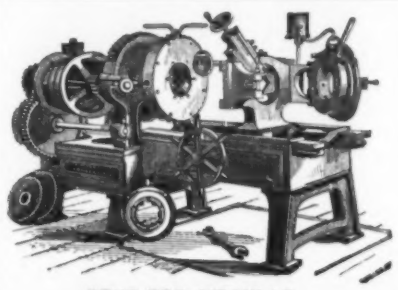

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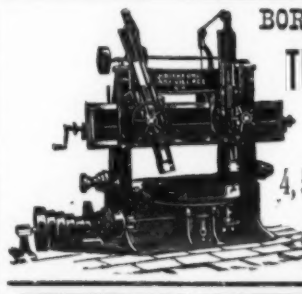

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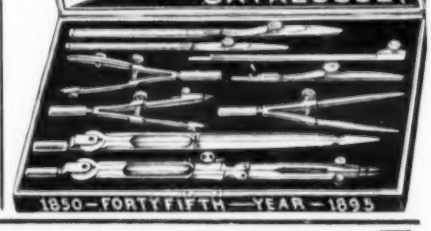

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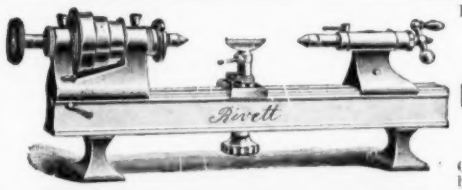

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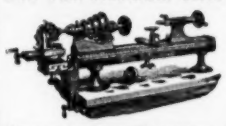

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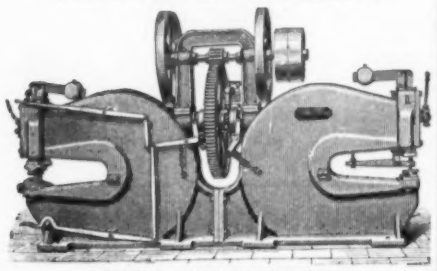

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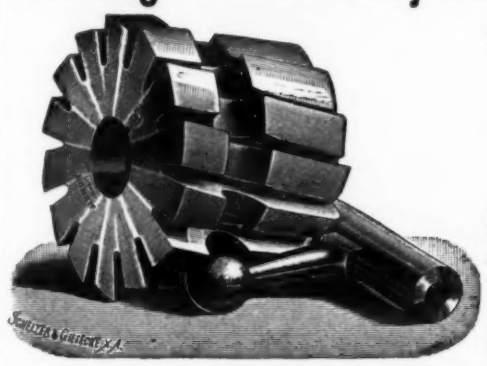

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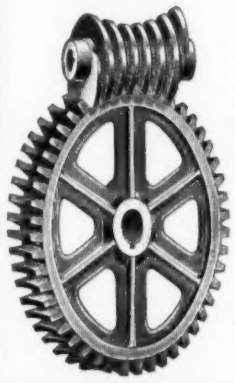

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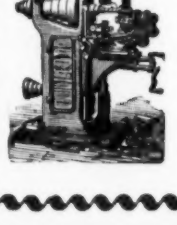

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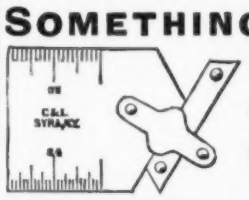

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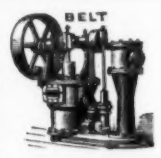

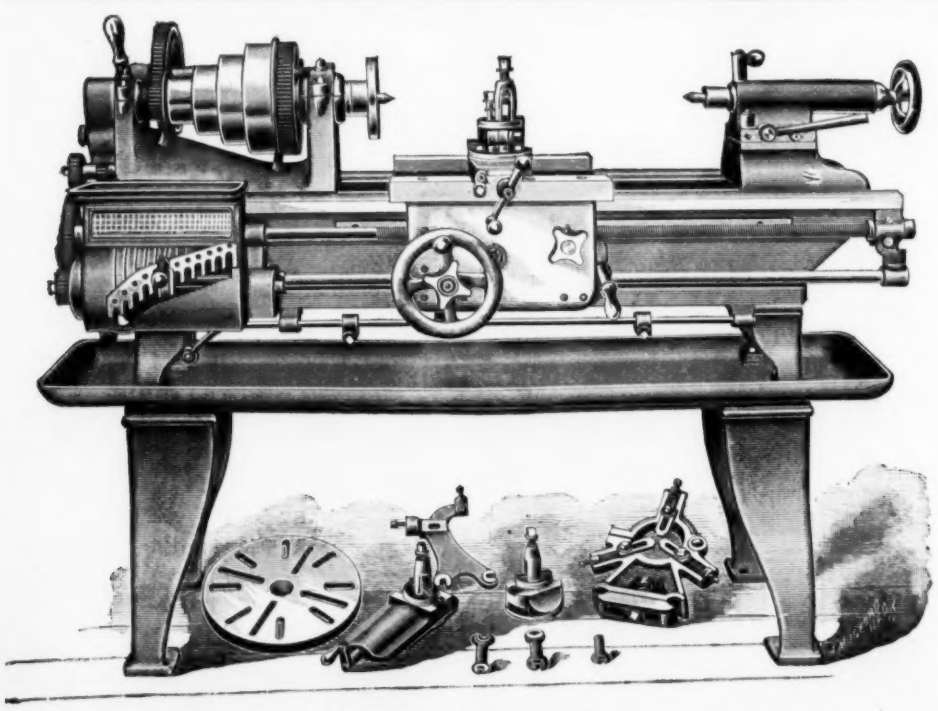

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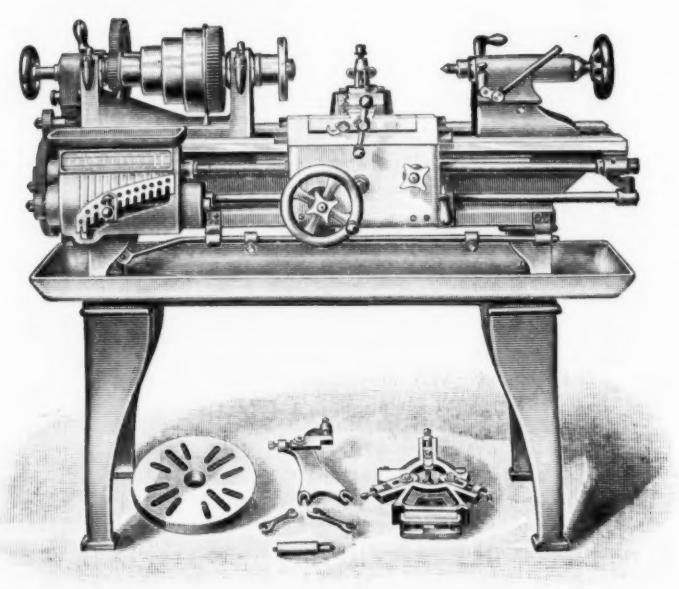

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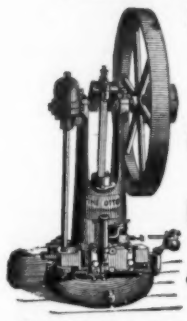

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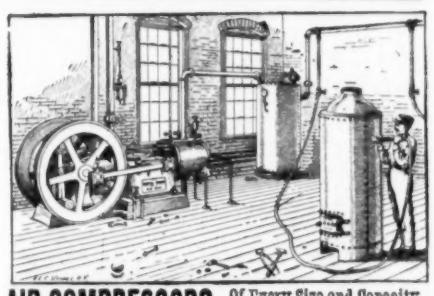

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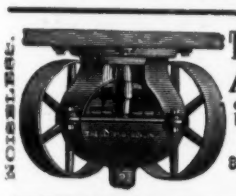

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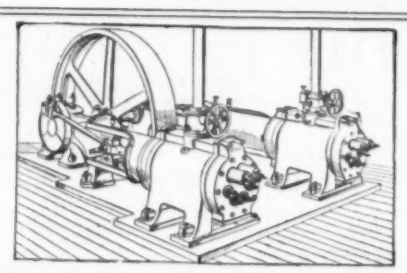

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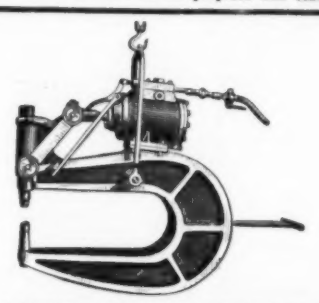

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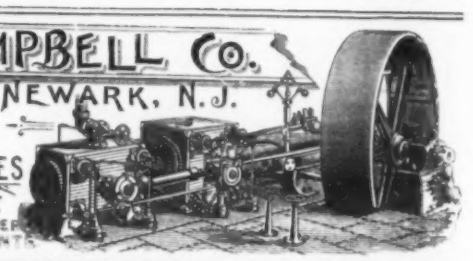

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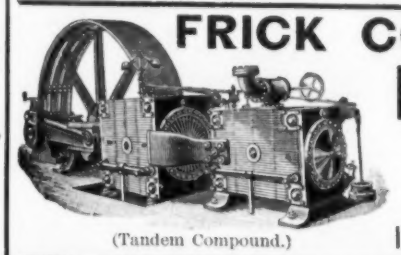

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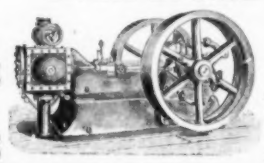

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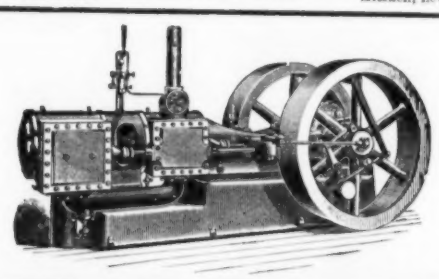

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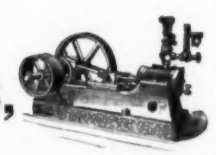

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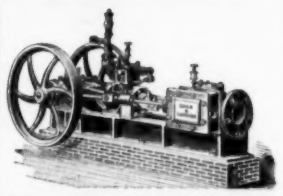

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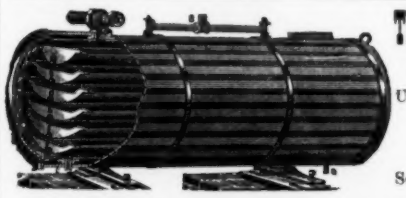

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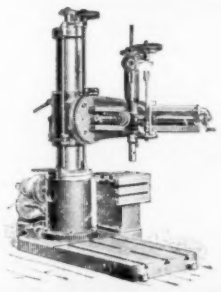

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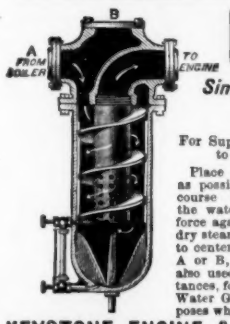

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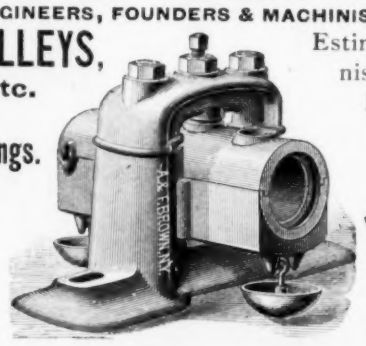

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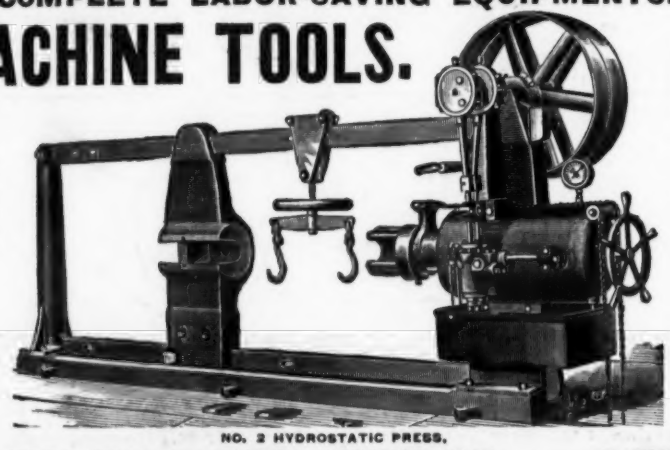

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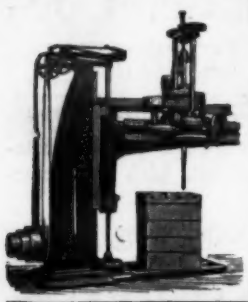

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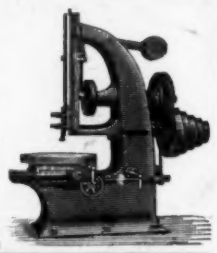

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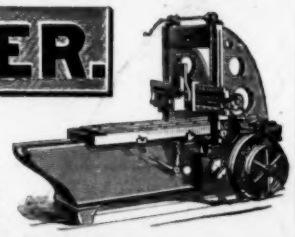

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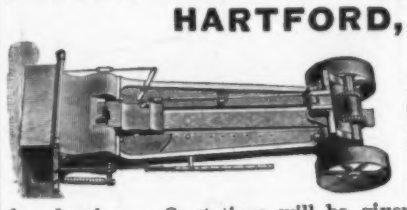

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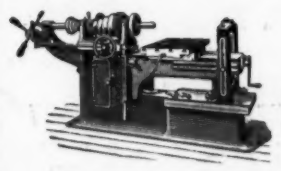

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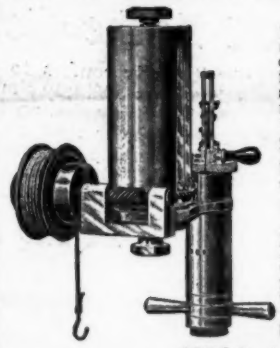

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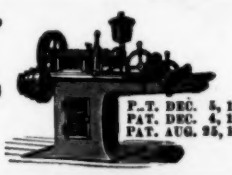

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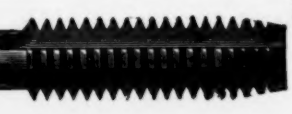

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